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Implementation of the Diabetes Practice Guideline in the Army Medical Department

Final Evaluation

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Preface

The RAND Corporation has worked with the Army Medical Department (AMEDD) on a project entitled "Implementing Clinical Practice Guidelines in the Army Medical System." This project was undertaken to assist the AMEDD in developing and testing methods to effectively implement clinical practice guidelines in Army military treatment facilities (MTFs), with the goal being to achieve consistent and quality clinical practices across the Army health system. Three demonstrations were conducted to test and refine methods before embarking on full guideline implementation across the Army health system. These demonstrations tested use of guidelines for primary care management of low back pain, asthma, and diabetes.

This report presents the final findings from the RAND evaluation of the diabetes practice guideline demonstration, which was conducted in 2000 and 2001. The evaluation included both an assessment of the implementation process and a quantitative analysis of changes in clinical practices. The quantitative analysis was performed to document the extent to which intended actions were actually implemented by the MTFs, assess short-term effects on clinical practices, develop and test metrics and measurement methods that can be adopted by the AMEDD for routine monitoring of progress, and assess the quality and limitations of available data for monitoring practice improvements and clinical outcomes. Recommendations for future actions by the AMEDD are presented.

This report is one of three final reports being generated in this project. It should be of interest to anyone concerned with military

medical systems and policies. Similar reports were prepared from the demonstrations for the low back pain and asthma practice guidelines.

This research was sponsored by the U.S. Army Surgeon General. It was conducted jointly by the RAND Arroyo Center, a federally funded research and development center sponsored by the U.S. Army, and by the RAND Center for Military Health Policy Research.

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Background

The Department of Defense (DoD) and Department of Veterans Affairs (VA) initiated a collaborative project in early 1998 to establish a single standard of care in the military and VA health systems. This initiative established evidence-based clinical practice guidelines for selected conditions that would be applied in all DoD and VA health facilities. Each practice guideline is a statement of best practices for the management and treatment of the health condition it addresses. For each guideline, the DoD/VA Working Group designated an expert panel to develop the guideline contents and relevant metrics, which were made available for use by the military services and VA health-care facilities.

The Army Medical Department (AMEDD) has made a commitment to establishing a structure and process to support its military treatment facilities (MTFs) in implementing evidence-based practice guidelines with the goal of achieving best practices that reduce variation and enhance quality of medical care. The AMEDD contracted with RAND to work as a partner in the development and testing of guideline implementation methods for ultimate application to an Army-wide guideline program.

Taking the approach of testing new methods on a small scale, AMEDD fielded three demonstrations over a two-year period, each testing different clinical practice guidelines. All three of the practice guidelines—for lower back pain, asthma, and diabetes—were established collaboratively by the VA and DoD. This report presents the

results from a RAND evaluation of the diabetes practice guideline demonstration. The principal emphasis of the practice guideline for primary care management of diabetes was on effective management of blood-sugar levels with the goal of preventing short-term complications and long-term effects on organ systems.

The key elements of the Diabetes Practice Guideline were the following:

- patient evaluation,
- achieving and maintaining glycemic control,
- patient education and counseling, and
- early detection and management of diabetic complications.

Approach

AMEDD began the demonstration process in AMEDD's Western Region with a kickoff meeting in December 1999 (implementation processes and tools are summarized in the list below). Two MTFs participated in the demonstration as designed: Madigan Army Medical Center (AMC), Fort Lewis, Washington, a large, urban specialty medical center, and Bassett Army Community Hospital (ACH), Fort Wainwright, Alaska, a small hospital at a remote outpost. Three other Army MTFs concurrently implemented the diabetes guideline in a separate demonstration.[1] Data for all five MTFs were included in the evaluation of guideline effects.

The following processes and tools were used in guideline implementation:

- the practice guideline and metrics,

[1] In this three-year demonstration of a program called TRICARE Senior Prime, DoD contracted with Medicare to offer Medicare managed-care plans in six locations for DoD beneficiaries who also were Medicare-eligible. One participation requirement for the Senior Prime plans was to implement a quality improvement initiative; diabetes care was chosen. The three sites for which data were included in this report were Brooke AMC at Fort Sam Houston, Texas, Evans ACH at Fort Carson, Colorado, and Reynolds ACH at Fort Sill, Oklahoma.

- a guideline toolkit of materials to support implementation activities,
- a kickoff conference to develop implementation action plans,
- MTF implementation activities to carry out the action plans, information exchange between teams and with MEDCOM to share experiences and build on successes,
- ongoing support of MEDCOM to include revision and development of toolkit items, and
- monitoring of implementation progress by both MEDCOM and the participating MTFs.

RAND's evaluation included an assessment of the implementation process, an attempt to establish preimplementation baseline measurements as benchmarks, an assessment of the effects of the guideline implementation on care processes one year later, and an evaluation of methods available to and developed by AMEDD to measure outcomes at its facilities. The specific methods and data used in the evaluation are described in Chapter Two and Appendix A.

Implementation Evaluation

Earlier demonstrations had shown the value of using a systems approach, which involved achieving "buy-in" from the staff responsible for implementing the new practices and ensuring that clinical and administrative systems are in place to facilitate staff adherence to the guideline. The purposes of the *process evaluation* were to document the actions and experiences of the participating MTFs; identify areas where AMEDD policies, systems, and processes could be strengthened; and assess the degree to which AMEDD can apply lessons from the demonstration to implement the diabetes guideline across its system. A participant-observer approach was used to learn from the MTFs' experiences, provide feedback, and facilitate shared learning among the MTFs. Information was collected from the participating MTFs through two site visits (one at four months and one at ten months), monthly progress reports prepared by the MTFs, and questionnaires completed by individual participants.

The Outcomes Evaluation

The purposes of analyzing the outcomes of guideline implementation were to document the extent to which intended actions were actually implemented by the MTFs, monitor short-term effects on service delivery methods and activity, and develop and test metrics and measurement methods that can be adopted by the MTFs and MEDCOM for routine monitoring of progress. Outcomes were evaluated using two sets of indicators. First, the participating MTFs assessed their own compliance with a set of indicators developed by the nationwide Diabetes Quality Improvement Project (DQIP) and adopted by the DoD/VA Diabetes Working Group as guideline metrics. RAND established a second set of five outcome indicators that could be measured using administrative data from the DoD health system. Of these five indicators, one—annual eye examinations—reflected DQIP standards. The other four were primary care visits, use of oral hypoglycemic agents, emergency room (ER) visits, and inpatient stays. Other DQIP indicators could not be assessed using administrative data. These included foot exams, referrals to diabetes education services, and assessment for nephropathy because such information was collected and stored only at the local MTF level.

To assess the effects of the demonstration, we used a time series, control comparison design to assess changes in values of the MTFs' performance indicators over time. While the kickoff meeting was held in December 1999, we considered April 1, 2000, to be the date when the guideline might impact patient care and thus defined the baseline period as the year preceding this intervention date. To control for temporal trends that might account for observed changes in the indicators, we also compared the data for the demonstration sites to those of a set of matched control MTFs that had not implemented the diabetes guideline. These comparison MTFs were selected for similarity to the demonstration MTFs. For the time trend comparisons, we analyzed one year of baseline data for the demonstration sites (April 1999 through March 2000) and one year of data collected after introduction of the guideline (April 2000 through March 2001).

The patient sample used for these analyses was a subset of all patients who were enrolled in TRICARE Prime at one of the five

demonstration MTFs (the two MTFs in our demonstration plus the three Senior Prime MTFs) or five comparison MTFs during the study period. For each indicator, we calculated averages for the sample of diabetic patients continuously enrolled at each MTF during the baseline period and an overall average value for both control and demonstration MTFs.

To gain perspective on how the demonstration participants reflected diabetes patients served by Army facilities, we also documented the number and characteristics of all DoD beneficiaries who were identified as having diabetes and who used an Army MTF at any time during the study period, based on International Classification of Diseases, Ninth Revision (ICD-9), diagnostic codes on MTF encounter records, or network provider payment claims.

Findings and Implications

Army medical facilities served close to 220,000 diabetic patients during the first year of our study and more than 230,000 diabetic patients during the second year, more than half of whom were personnel, retirees, or family members of other (non-Army) military services. Among those affiliated with the Army, all but a small fraction were either retired Army personnel or their family members. Only a small number were active-duty Army personnel: Overall, 42.8 percent of the diabetic patients in the first year were 45 to 64 years of age, and 46.2 percent were 65 years of age or older. The percentages were similar for the second study year.

The patients in our sample used both MTFs and network providers for their diabetes care. Only 61.8 percent of total diabetes-related visits to MTF outpatient clinics or ERs were by patients enrolled in TRICARE Prime at the MTFs. Another 37.6 percent of these MTF visits were for nonenrolled patients, and less than 1 percent of the visits were for patients enrolled with network providers. By contrast, all but a small percentage of diabetes-related hospital inpatient stays at MTFs were for their own enrollees. This finding has

implications for both patient management and outcome measurement.

Baseline Diabetes Care Performance Measures

Baseline values varied considerably for all indicators: average number of primary care visits per 100 patients, percentages of non–insulin dependent patients who were treated with oral agents, percentages of diabetes patients who had at least one eye examination during the year, rates of ER visits, and rates of inpatient stays. No practice guidelines yet define the optimal number of primary care visits and the use of oral agents because appropriate measures depend on individual patient needs and clinical judgment. Nevertheless, the wide variation in practices among facilities suggests that under- or overtreatment may be a concern. Baseline levels of annual eye exams, an indicator for which guidelines exist, were uniformly low, suggesting the need to investigate possible underlying causes.

Critical Factors for Implementing Practice Improvements

Drawing on published literature on implementation of practice guidelines and the implementation experiences observed in the AMEDD lower back pain and asthma guideline demonstrations, we identified six factors that critically influence the successful integration of new practices into clinical and administrative processes. We assessed the performance of the diabetes guideline demonstration MTFs on these factors.

- **Command leadership commitment at the MTF, regional, and corporate levels.** The diabetes implementation teams had the support of both the MTF commands as well as the leadership of the TRICARE Region 11 Lead Agent office, which planned to implement this approach for other MTFs in the region.
- **Monitoring progress.** The performance of the demonstration MTFs in the area of monitoring was mixed. Of the two demonstration MTFs (not including the Senior Prime sites), one actively measured trends in performance on the DQIP measures,

while the other MTF struggled to extract the needed data in the face of inadequate staffing levels and technical problems with its data system. Data system barriers also prevented both MTFs from establishing a local diabetes registry.

- **Guidance and support to the MTFs by MEDCOM.** By the time the diabetes guideline demonstration began, MEDCOM had well-established staffing and other resources and was providing policy guidance and technical support to help MTFs implement practice improvements for diabetes care. We believe MEDCOM's committed support has been a strong foundation for the practice improvement efforts of the demonstrations.
- **Guideline champions who are opinion leaders.** The participating MTFs identified well-respected physicians to serve as guideline champions for the diabetes demonstration, and these physicians showed a commitment to leading the implementation activities. However, the champions were permitted to make only limited commitments to the initiative.
- **Resource support for champions.** Although both MTF commanders authorized the champions to lead the implementation of the diabetes guideline, neither champion received tangible resource support for the activities (other than attendance at the kickoff conference). Nevertheless, facilitators designated by the commanders at both MTFs were responsible for providing staff support for the champions.
- **Institutionalization of new practices.** The participating MTFs made some progress toward achieving practices consistent with the diabetes guideline, focusing on areas where their performance on DQIP measures was the weakest. To achieve sustained improvements, they will need to both conduct regular education sessions for providers, clinic staff, and newcomers to the MTF and deliver regular feedback to providers on performance trends for the DQIP measures.

Effects of the Demonstration on Performance Measures

Data from both the local MTFs and the centralized data system can and should be used for monitoring progress of the MTFs on per-

formance indicators for diabetes care (or any other health condition). Based on process evaluation information and our analyses of encounter data, we examined trends reported by the demonstration MTFs for the DQIP performance indicators they monitored, and we also analyzed trends in diabetes care service utilization that we could obtain from administrative data for both demonstration and control sites.

MTF Monitoring of DQIP Indicators. Four of the five demonstration MTFs reported that they had begun to collect data on the DQIP measures using either their clinical data systems or medical charts as data sources. Three of these MTFs reported an improvement in their performance between baseline and 12 months into the demonstration. Such improvements could lead to an eventual reduction in diabetes complications and associated avoidable health-care events (e.g., ER visits or hospitalizations).

In our review of the materials the MTFs provided, several issues arose regarding data quality and comparability across MTFs, including incomplete or ambiguous indicator definitions (e.g., percentage of patients receiving a lipids panel versus the percentage of patients with LDL levels in the normal range).

RAND Analysis of Service Utilization Trends. The performance of the demonstration MTFs on the service delivery indicators we measured did not change substantially between baseline and the end of the first demonstration year:

- Primary care visit rates held steady during the first two quarters of the first demonstration year and then decreased in the last two quarters.
- Use of oral hypoglycemic agents at demonstration MTFs increased from baseline during the demonstration period, as expected, but this increase did not differ significantly from that of the control MTFs.
- The percentage of patients with diabetes-related annual eye examinations increased significantly at demonstration MTFs, but it was not clear whether this was a real increase or the result

of improved coding for the diabetes diagnosis on the encounter records.
- Neither ER visit rates nor hospitalization rates—indicators of potentially avoidable health-care events—changed during the demonstration.

RAND Analysis of MTF Cost Trends. The introduction of the diabetes practice guideline did not appear to affect MTF costs in the first demonstration year:

- As a proportion of total costs of diabetic care per patient and per MTF, costs of care for nonenrollees was substantial at both demonstration and control hospitals. Nonenrollee inpatient costs far exceeded enrollee inpatient costs. Many of the nonenrollees were over-65 Medicare recipients.
- For enrollees, per-patient costs at demonstration hospitals exceeded those of control hospitals for both inpatient and outpatient care and in both study years. From year one to year two, average per-patient costs for both outpatient and inpatient care increased slightly at the demonstration sites, while at the control sites, outpatient costs rose slightly and inpatient costs fell.
- For nonenrollees, per-patient costs at demonstration hospitals were comparable to or slightly less than those of control hospitals for both study years. From year one to year two, average per-patient costs for both outpatient and inpatient care fell slightly at demonstration sites, while at the control sites, outpatient and inpatient costs rose slightly.
- From one MTF to another, per-patient costs for both outpatient and inpatient services varied widely.

The contrast between improvements on the DQIP indicators reported by the demonstration MTFs and the virtual absence of changes in the cost indicators we analyzed suggests that our measures did not capture the full dynamics of the process changes made by the MTFs to achieve their reported improvements on the DQIP indica-

tors. While administrative data can be used to count events (e.g., visits), they cannot be used to assess the contents of those events (e.g., diabetes education, foot exams, or referrals). Although we were familiar with the action strategies of the two MTFs in the AMEDD demonstration and the specific processes they were attempting to modify, we could not develop indicators that measured those changes using administrative data, with the exception of annual eye exams.

Other possible contributors to the apparently limited effects of the demonstration include the following:

- the time between implementation and measurement may have been too short for the guideline to have affected diabetes complications sufficiently to be reflected in ER and inpatient care rates;
- some of the demonstration MTFs already had been working on improving diabetes care before the demonstration;
- the TRICARE Senior Prime MTFs included in the analysis were not fully supported by RAND and MEDCOM;
- data were not available at the MEDCOM-level for the measures targeted by the MTFs' action plans;
- data quality issues existed for patient identifiers, coding, and clinical laboratory and pharmacy data;
- MEDCOM lacked centralized support for data acquisition and monitoring.

The very real barrier created by inadequate availability of healthcare data not only hinders the ability to measure the progress of the MTFs in diabetes care practice improvements but also weakens the improvement process itself by depriving the MTFs and MEDCOM of the feedback needed to guide adjustments to the quality improvement actions being taken by the MTFs. This barrier will continue to slow progress in improving practices under the diabetes guideline as well as other guidelines. The ability of MEDCOM to alleviate the burden on its MTFs to establish a valid process for data collection

and monitoring will increase the likelihood that meaningful improvements in diabetes care will be achieved.

Recommendations

Although the MTFs participating in the diabetes practice guideline demonstration had some notable successes in some aspects of improving diabetes treatment practices, resource limitations and organizational barriers curbed the overall progress. Provided here are some additional lessons learned and recommendations.

Implementation

- *Allow for flexibility:* Flexibility in implementation strategies can help ensure that each MTF can address the clinic practices most in need of improvement and reflect unique capabilities, but it may put more responsibility on each MTF for defining its own direction, and it also may slow progress toward the AMEDD goal of achieving consistent practices across its facilities.
- *Provide and ensure adequate resources:* Provision of additional resources, including regular education sessions and feedback to providers, to support implementation activities would help the champions and teams achieve lasting improvements in practices.
- *Learn from experience:* MEDCOM should continue to strengthen its system in response to the lessons identified in the process evaluation for this demonstration as well as its experience in previous demonstrations.

Benchmarking of MTF Performance

- *Measure progress:* To provide an empirical foundation to guide performance priorities, MEDCOM and the MTFs should use baseline service data as an integral part of the regular monitoring for effective diabetes care to identify facilities at greatest variance from established standards and identify factors contributing to the variance. Interventions should be undertaken to correct identified performance problems.

Outcomes Measurement

- *Document variations:* MEDCOM should continue to document variations in performance on key indicators across MTFs on a regular basis to identify areas where improvements in quality and greater consistency are needed.
- *Select indicators and apply them carefully:* It is important to institute a set of indicators that are widely in use across the country, including instructions on how to calculate the measures. In addition, careful measurement of the numerators and denominators for performance indicators will be required to ensure effective monitoring of progress.
- *Educate and engage providers and staff:* Educating and actively engaging both providers and clinic staff on the diabetes practice guideline can help achieve sustainability of improved practices.
- *Include patient education as part of implementation:* Patient education is an important aspect of diabetes care, especially for the new diabetes patient. Further assistance by MEDCOM might be useful to enhance the ability to reach all patients and offer comprehensive education for managing the various aspects of their diabetes.
- *Provide ongoing monitoring and technical support:* The achievement of sustainable practice improvements can be encouraged by MEDCOM through ongoing monitoring and technical support for the implementation activities of the Army MTFs. Also, to successfully introduce and consolidate new habits among a large number of providers and clinic staff, implementation activities require not only resources but also time to mature.
- *Develop a patient registry: For* patients with chronic conditions, such as asthma or diabetes, a registry would provide a centralized repository of pertinent data that could be shared by all MTFs as the patients move around the military system. Although AMEDD does not have centralized registries, many of the local MTFs are attempting to establish them for their patient populations.
- *Improve centralized data collection:* Two approaches for improvement may be considered. MEDCOM could establish a central-

ized system that collects the data directly from automated data systems, performs analyses in the central office, and generates trend reports to the MTFs. Alternatively, the system could use data collected and analyzed locally by the MTFs and reported to MEDCOM, which then would aggregate the individual MTF results into trend reports.

Costs

- *Track and monitor service use and costs of time:* MEDCOM should continue to track inpatient use rates and costs over time. As cost information accumulates, it should be possible to distinguish trends related to practice changes from normal fluctuations in health-care needs from year to year.

Acknowledgments

An extraordinary amount of dedication and hard work by numerous individuals contributed to the performance of the AMEDD demonstration for implementing the DoD/VA diabetes guideline in the Western Region. In particular, we wish to acknowledge the efforts of the guideline champions, facilitators, and action team members at the Army treatment facilities participating in the demonstration. These teams persisted in their implementation efforts, achieving observable progress in changing clinical practices and offering invaluable feedback on how to make the process stronger and more efficient.

We also acknowledge the commitment of the leadership team at MEDCOM who have guided this project and have participated as active partners in both the development and evaluation work on the diabetes demonstration. Lt. Col. Kathryn Dolter, who has primary responsibility for the MEDCOM guideline implementation program, showed steadfast commitment to learning from the demonstrations and making this program come to life. The personnel in the Patient Administration Systems and Biostatistical Activity (PASBA) also made a major contribution to the evaluation by generating the administrative data for the analysis of the effects of guideline implementation. Their careful data extraction and programming efforts ensured the needed data integrity. The lead agent office personnel for TRICARE Region 6 helped to strengthen our analysis by sharing their evaluation results for the Army MTFs that participated in the Senior Prime demonstration, which we also included in part of this evaluation. Without the policy and financial support of the Center

for Healthcare Education and Studies, headed by Col. Harrison Hassell, this project would not have been possible.

Finally, we offer our thanks to our RAND colleagues Jeffrey Wasserman and Lee Hilborne for their thoughtful review of an earlier draft of this final report. Their suggestions for revisions helped to make it a stronger document. Any errors of fact or interpretation are, of course, the responsibility of the authors and not any of those who provided feedback on our efforts.

Abbreviations

ACH	Army Community Hospital
ADS	Ambulatory Data System
AMC	Army Medical Center
AMEDD	Army Medical Department
CDC	Centers for Disease Control and Prevention
CHCS	Composite Health-Care System
CHPPM	Center for Health Promotion and Preventive Medicine
DDS	DEERS Dependent Suffix (TRICARE enrollment)
DEERS	Defense Enrollment Eligibility Reporting System
DMIS	Defense Medical Information System
DMIS ID	Defense Medical Information System identification
DoD	Department of Defense
DQIP	Diabetes Quality Improvement Project
DRG	Diagnosis-Related Group
ER	Emergency room
FMP	Family Member Prefix
HBA_1c	Hemoglobin A_1c
HCSR	Health-Care Service Records

ICD-9	International Classification of Diseases, Ninth Revision
ICU	Intensive-care unit
LDL	Low-density lipoprotein
MEDCOM	(U.S. Army) Medical Command
MEPRS	Medical Expense and Performance Reporting System
MTF	Military treatment facility
NMOP	National Mail Order Pharmacy
OBD	Occupied Bed Days
PASBA	Patient Administration Systems and Biostatistical Activity
PDA	Personal digital assistant
PEC	PharmoEconomic Center
PHSD	Population Health and Safety Division (Air Force)
PLCA	Patient-Level Cost Allocation
SADR	Standard Ambulatory Data Record
SIDR	Standard Inpatient Data Record
SSN	Social Security number
TMA	TRICARE management activity
TMC	Troop Medical Clinic
USPCC	U.S. per-capita costs
USPD	Uniformed Services Prescription Database
VA	(Department of) Veterans Affairs

CHAPTER ONE

Introduction

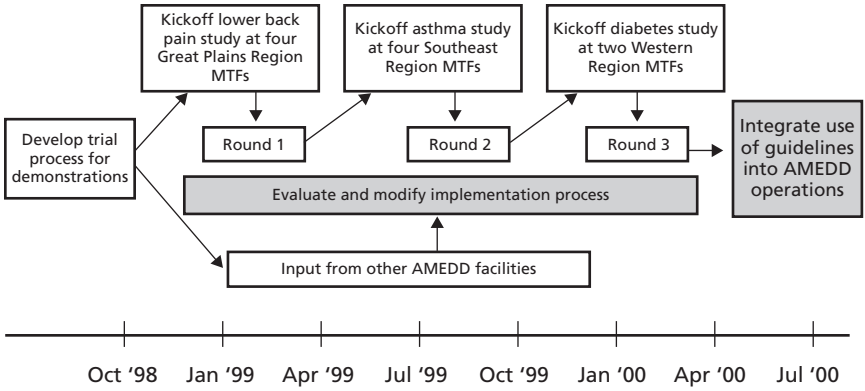
The Army Medical Department (AMEDD) has made a commitment to establishing a structure and process to support its military treatment facilities (MTFs) in implementing evidence-based practice guidelines to reduce variation and enhance quality of medical care. Each practice guideline is a statement of best practices for the management and treatment of the health condition it addresses, taking into account the strength of relevant scientific evidence, which is documented in the practice guideline report. The guidelines support clinical discretion on the part of the provider while identifying specific practices that are either strongly advised or not advised.

The process of guideline implementation includes monitoring the effects of practice improvements on clinical care outcomes. With the goal of establishing implementation and monitoring of practice guidelines, AMEDD contracted with RAND to work as a partner in developing and testing implementation methods for ultimate application to an Army-wide program of guideline-driven practice.

The AMEDD/RAND project fielded sequential demonstrations over a two-year period (Figure 1.1) to test implementation of clinical practice guidelines for three conditions: lower back pain, asthma, and diabetes mellitus. This approach enabled AMEDD to test and refine new methods on a small scale and then to apply these methods for rolling out use of practice guidelines across the Army health system.

All of the demonstrations worked with practice guidelines that were established collaboratively by the Departments of Veterans

Figure 1.1
Diagram of the Demonstration Project



NOTE: Two MTFs participated in the diabetes demonstration, and data for an additional three MTFs that also implemented this guideline were used in the analysis of effects of implementing the guideline.

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Affairs (VA) and Defense (DoD). The diabetes guideline demonstration was the last of the three demonstrations and was implemented by two MTFs in AMEDD's Western Region. In the first demonstration, four MTFs in the Great Plains Region implemented the low back pain practice guideline. The second demonstration evaluated the implementation of the asthma guideline by four MTFs in the Southeast Region.

RAND performed evaluations for each demonstration: the evaluations included an assessment of the implementation process and an analysis of effects on clinical practices and service use. The primary purpose of the evaluations was to learn from the experiences of the participating MTFs, with respect to both their implementation processes and the feasibility and data requirements for measuring effects of the practice changes they introduced. Thus, many aspects of the evaluation were exploratory, and this report documents lessons learned in both areas. Specific components of this work included:

- **Implementation process evaluation**—documented the implementation activities of participating MTFs, described their suc-

cesses in changing clinical practices, identified successes and challenges reported by the sites, and obtained their feedback regarding MEDCOM support.
- **Analysis of effects and costs**—estimated the extent to which the sites' implementation activities affected specific measures of service delivery for diabetes, with comparisons to a control group of MTFs that did not implement the guideline, as well as analysis of changes in costs related to use of the guideline.
- **Benchmarking**—described variations in practices across MTFs for the measures used in the analysis of effects to help identify priorities for future interventions and for comparing individual facilities to benchmarks for target levels of performance.
- **Methods development**—documented the measurement methods developed and the related data requirements to provide a basis for future systemwide monitoring of progress in achieving best practices for each condition addressed by a guideline.

The remainder of this chapter summarizes the process DoD and the VA used to establish practice guidelines and the approach used by the Army Medical Command (MEDCOM) for implementing the guidelines in the Army health system.

The DoD/VA Guideline Adaptation Process

DoD and the VA initiated a collaborative project in early 1998 to establish a single standard of care in the military and VA health systems. It is led by a working group consisting of two representatives from the Army, Air Force, Navy, and VA. The goals of this project are adaptation of existing clinical practice guidelines for selected conditions, selection of two to four indicators for each guideline to benchmark and monitor implementation progress, and integration of DoD/VA prevention, pharmaceutical, and informatics efforts.

The DoD/VA Working Group designates an expert panel for each practice guideline consisting of representatives from the three military services and the VA with a mix of clinical backgrounds rele-

vant to the health condition of interest. The expert panel reviews existing national guidelines for that condition, examines and updates the scientific evidence supporting the guidelines, and adapts the guidelines for the military and VA health systems. Each panel also develops recommendations for the metrics to be used to monitor progress in guideline implementation.

Overview of the Diabetes Practice Guideline

The principal emphasis of the DoD/VA diabetes practice guideline is on effective management of blood sugar, with the goal of preventing short-term and long-term complications of the disease. The five key elements of the guideline are presented in Table 1.1.

The first three key elements are the core procedures for diagnosis and management of diabetes, including ongoing patient evaluation, achievement and maintenance of glycemic control, and patient education. The fourth and fifth key elements address early detection and management of diabetes-related clinical problems. Procedures include screening for elevated blood pressure, eye complications, foot lesions, elevated cholesterol or lipids, and renal disease, all of which can lead to life-threatening complications from diabetes.

Expected Effects on Health-Care Practices

Any change in clinical practices that may be observed as MTFs implement the diabetes guideline should reflect the guideline's emphasis on effective glycemic control and patient self-management practices, coupled with regular monitoring for diabetes-related problems.

A set of performance indicators for diabetes care has been developed through the Diabetes Quality Improvement Project (DQIP).[1]

[1] The DQIP is sponsored by a public/private coalition that includes the American Diabetes Association, Foundation for Accountability, Centers for Medicare and Medicaid Services,

Table 1.1
Key Elements of the DoD/VA Diabetes Practice Guideline

Key Element	Description
Evaluation for Diabetes Mellitus	
Evaluate patient for existence and type of diabetes and stabilize patient for diabetes management.	Classify patient as type 1 or 2 diabetic and identify and document comorbid conditions. Assess medical, psychological, and social stability. Provide appropriate treatment and stabilization based on these assessments.
Glycemic Control	
Achieve appropriate glycemic control by assessing and managing glycosylated hemoglobin, reported as hemoglobin A_1c (HbA_1c) levels.	Assess HbA_1c levels relative to target range. If level is high, check for patient adherence problems and assess need to adjust glycemic control target. Provide appropriate interventions to improve patient compliance, adjust medication therapy, or manage side effects, including contraindications to treatment.
Patient Education	
Provide education for new and existing diabetes patients to increase disease knowledge and facilitate self-care.	Determine patient's extent of diabetes knowledge and self-management skills and provide education as needed on basic concepts and core competencies. If patient needs or wants further education, provide materials or refer to appropriate specialist for education or risk-focused intervention.
Prevention of Complications	
Review organ systems and set priorities for patient's care to manage problems early when they occur and prevent complications.	Review systems regularly to detect and manage related problems, including elevated blood pressure, eye exam at least annually, foot risk assessment or lesions, elevated cholesterol or lipids, and renal disease (albuminuria or elevated creatinine).
Management of End-System Involvement	
Manage treatment for end-system involvement when necessary through regular care and specialty referrals, as appropriate.	When related problems are identified, treat them as indicated and consider specialty referral to manage serious cases or secondary causes. Counsel patient on self-care and lifestyle modifications, reinforcing advice in follow-up. Continue to manage status of the problems at each office visit.

National Committee for Quality Assurance, American Academy of Family Physicians, American College of Physicians, DoD, and the VA.

These measures were adopted by the DoD/VA Working Group as the official metrics to be monitored for its diabetes practice guideline. Adoption of a practice guideline based on these measures predicts a number of changes in clinical practice (Table 1.2).

Table 1.2
Changes in Clinical Practices Predicted by Practice Guideline Implementation

Initial Assessment and Glycemic Control
Increased rates of primary care clinic visits for diabetes patients during the first quarter of practice guideline implementation, followed by a decline in visit rates during subsequent quarters
Smaller increases in primary care clinic visits for patients not being treated with insulin therapy, compared with patients using insulin because of visit frequency involved in adjusting insulin dosages
Increase in the percentage of noninsulin patients who fill prescribed medications to control HbA_1c levels
Increased referrals for diabetes education services
Increased percentages of patients with at least one test for glycosylated hemoglobin, reported as hemoglobin A_1c (HbA_1c)[a]
Increased number of HbA_1c level tests per diabetes patient
Larger increases in frequency of HbA_1c level testing for patients who are not being treated with insulin therapy, compared with patients using insulin
Decrease in average levels of HbA_1c for diabetes patients[a]
Decreased percentage of patients with HbA_1c at greater than 9.5 percent[a]
Decreased variation across patients in average levels of HbA_1c[a]
Evaluation and Prevention of Diabetic Complications
Increased percentage of patients assessed for nephropathy[a]
Increased percentage of patients receiving a lipid profile in a year[b]
Increased percentage of patients with a low-density lipoprotein (LDL) (less than 130 mg/dL[a])
Increased percentage of patients receiving a dilated eye exam at least annually[a]
Increased percentage of primary care visits at which patients receive a foot exam[a]
Management of Avoidable Hypo- or Hyperglycemic Episodes
Decreased number of emergency room (ER) visits for diabetes patients due to hypo- or hyperglycemia
Decreased rates of inpatient admission for hypo- or hyperglycemia following ER visits
Decreased number of total hospitalizations for diabetes patients
Increased number of diabetes patients with a primary care visit after a hospital discharge
Increased frequency of HbA_1c-level tests in the quarter following an ER visit or hospital stay

[a]These changes are also included in DQIP's recommendations.
[b]DQIP Guidelines call for an increase in two years.

A Systems Approach to Implementation

Most studies that have evaluated the effects of guideline implementation on health-care practices have been fairly narrow assessments of individual interventions to change provider behavior (e.g., education, audit and feedback, reminders) primarily because of researchers' efforts to design studies with effective controls. Results across studies are quite variable, explained partly by differences in the subject matter of the guideline, provider attitudes, and organizational characteristics (Grilli and Lomas, 1994; Chodoff and Crowley, 1995; Paradox, 1995; Eastwood and Sheldon, 1996). The results are often disappointing, as in the finding that nearly one-third of the time primary care providers fail to follow even noncontroversial and evidence-based guideline recommendations (Grol et al., 1998). Active methods, such as concurrent reminders and academic detailing, are more consistently effective than passive dissemination of guidelines or feedback. Combining two or more approaches seems more likely to succeed than relying on a single intervention, with multifaceted interventions targeted at identified barriers being the most successful (Bero et al., 1998; Grimshaw et al., 2001).

Influenced by systems thinking and quality improvement, health care managers favor multifaceted changes in systems, rather than single interventions, as the best hope for changing patient care practices (Senge, 1990; Shortell, Bennett, and Byck, 1998). The Chronic Care Model, for example, is testing the assumption that care of the chronically ill requires major changes in the organization and delivery of care, in information systems, in doctor-patient relationships, in patient self-management, and even in relationships between the health system and community resources (Wagner, Austin, and VonKorff, 1996; Von Korff et al., 1997). A premise of this and other integrated models is that testing the effects of individual components will yield misleading null results because dramatic changes in outcome *only* occur when all components of the model are in place.

An additional consideration is the distinction between provider-controlled and system-dependent guideline criteria (Hargraves et al., 1996). Because systems changes (such as computerized order entry

linked to decision support) can clearly change the degree of compliance with practitioner-controlled criteria (such as choice of antibiotic), determining the dominant influence on practice is difficult (Evans et al., 1998).

Basic Implementation Strategy

The AMEDD practice guideline implementation demonstrations applied a systems approach. This approach was amply supported by lessons from the earlier demonstrations, which documented the importance of addressing multiple factors influencing clinical practices. These demonstrations highlighted that two main dimensions need to be addressed to ensure successful changes in practices by MTFs and other local facilities: build local ownership or "buy-in" from the staff responsible for implementing the new practices and ensure that clinical and administrative systems are in place to facilitate staff adherence to the guideline.

Figure 1.2 presents a model of how staff buy-in and system changes can interact to produce different implementation results. Having *both* local ownership and system support produces the optimal result, leading to likely success. System support without local ownership produces providers resistant to implementation, despite having clinic procedures and systems equipped to support the process. Provider ownership without system support produces providers who wish to change practices but are frustrated by their inability to

Figure 1.2
Matrix of Implementation Outcomes

	Local ownership	No local ownership
Systems *do* support recommended practices	✓	Provider resistance
Systems *do not* support recommended practices	Frustrated providers	X

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overcome barriers in the MTF systems that hamper their ability to do so. Finally, with *neither* local ownership nor system support, implementation will fail.

Six Critical Success Factors

Drawing on published literature and the experiences observed in the AMEDD demonstrations, we identified six critical success factors that strongly influence how successfully an MTF will be able to integrate new practices into its clinical and administrative processes:

- Visible and consistent commitment by command leadership at the MTF, regional, and corporate levels, including both statements establishing a priority for the work and actions that support those statements. Such support has been shown to be necessary to empower teams to change practices effectively (Solberg et al., 1997; Keller, 1997; Motwani, Klein, and Navitskas, 1999; Savitz and Kaluzny, 2000).
- Ongoing monitoring of progress in carrying out an implementation plan, to be performed by both the MTFs and the Army Medical Command (MEDCOM), with regular feedback to the MTFs on the effects of their actions on desired outcomes (Palmer and Hargraves, 1996; Sasala and Jasovsky, 1998; Cox et al., 1999; Lescoe-Long and Long, 1999; Savitz and Kaluzny, 2000).
- Provision of implementation guidance and support to the MTFs by MEDCOM, including toolkits of support materials and ready access to staff support and other resources. Such support encourages MTFs to make needed practice changes to move toward consistency in practices across the Army facilities (Sasala and Jasovsky, 1998; Motwani et al., 1999).
- Identification of a physician at each MTF who is a respected local opinion leader to serve as guideline champion and lead the MTF's implementation activities (Palmer and Hargraves, 1996; Solberg et al., 1997; Gandhi et al., 2000).
- Provision of adequate dedicated time and other resource support for the guideline champions to enable them to perform their

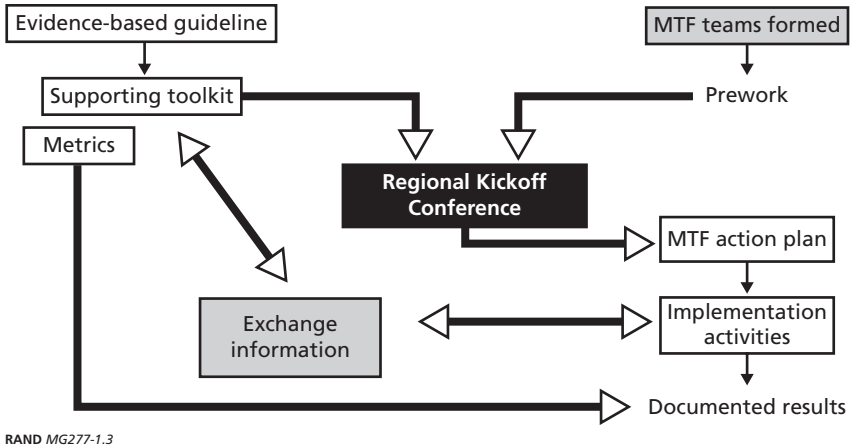
tasks effectively. Such support also will reinforce the signals that guideline implementation is a priority for the MTF command (Palmer and Hargraves, 1996; Lescoe-Long and Long, 1999; Gandhi et al., 2000).
- Institutionalization of new practices as part of a clinic's normal (routine) procedures within a finite period. This requires successful design and execution of an action plan to change practices, including both educational and systems change interventions (Solberg et al., 1997; Motwani et al., 1999).

The AMEDD Guideline Implementation Process

The systems approach applied in the demonstrations to implement the practice guidelines is shown in Figure 1.3. This process consisted of the following components:

- **Practice guideline and metrics.** The official DoD/VA practice guideline materials are provided to the MTFs, including a summary list of the key elements of the guideline and metrics identified by the guideline expert panel for monitoring progress.
- **Guideline toolkit.** The MEDCOM and the Center for Health Promotion and Preventive Medicine (CHPPM) collaborated in the development of a toolkit of materials to support the MTFs' guideline implementation activities (e.g., documentation forms, provider training videos, patient education materials, reminder cards). Toolkits are provided to each of the demonstration MTFs, and consumable items are replenished as needed. Toolkit contents were revised based on demonstration MTF feedback.
- **Kickoff planning conference.** Multidisciplinary teams from the demonstration MTFs participate in a two-day interactive meeting to develop their guideline implementation strategies and action plans. Interaction is within and between teams and with RAND and MEDCOM facilitators.
- **MTF implementation activities.** Following the kickoff conference, the MTF teams carry out their action plans. They prepare monthly reports that summarize their recent activities, successes, challenges, and assistance needed to support their work.

Figure 1.3
Guideline Implementation Process



- **Information exchange.** Teams are encouraged to share their experiences with each other and with RAND and MEDCOM facilitators so they can learn from errors and build on successes. Communication occurs through MEDCOM-supported listservs (mailing list programs for communicating with other people who have subscribed to the same list) and direct e-mail.
- **Monitoring of progress.** Monitoring of implementation progress is performed by both MEDCOM and the participating MTFs through site visits and data monitoring. Monitoring at the MEDCOM level focuses on metrics that have been developed in the DoD/VA guideline process. MTF monitoring uses either DoD/VA guideline metrics or guideline implementation process metrics. The MTFs were encouraged to establish measures for their key strategies to enable them to assess their progress in making the clinical process changes they intended.

The Demonstration Sites

The diabetes demonstration was carried out in the Army's Western Region. The Western Region was selected for the third and final

demonstration because MTFs in that region had not yet had training in the AMEDD guideline implementation system and methods, and one MTF (Madigan Army Medical Center [AMC]) was known to have a large number of diabetic patients.

Two MTFs in the Western Region—Madigan AMC, Fort Lewis, Washington, and Bassett Army Community Hospital (ACH), Fort Wainwright, Alaska—served as the demonstration sites. These two MTFs offer a strong contrast between a large, specialty medical center in an urbanized area (Madigan) and a small community hospital at a remote military post (Bassett). Madigan AMC, the largest military hospital on the west coast, has 222 inpatient beds and a full range of primary and specialty care capabilities. It serves as the regional referral center for smaller MTFs and clinics operated by the Army, Air Force, and Navy. Bassett ACH is a 43-bed hospital at Fort Wainwright near Fairbanks, the northernmost Army installation. These two MTFs also serve very different sizes and mixes of beneficiary populations. As shown in Table 1.3, Madigan's catchment area contains an estimated 92,000 beneficiaries, of whom 31.6 percent are retirees. About 2 percent of Madigan's beneficiaries are diabetic patients. Bassett ACH serves about 22,000 beneficiaries north of the Alaska Range through the hospital and several outlying clinics. Of Bassett's 22,000 beneficiaries, only 15.7 percent are retirees. Less than 2 percent of beneficiaries at Bassett ACH are diabetes patients.

Simultaneous with the start of the AMEDD demonstration, three other Army MTFs implemented the diabetes guideline as part

Table 1.3
Profiles of the Military Treatment Facilities Participating in the Diabetes Guideline Demonstration

	Madigan AMC, Fort Lewis		Bassett ACH, Fort Wainwright	
Type of Beneficiaries	**Number**	**Percentage**	**Number**	**Percentage**
Active-duty	22,878	24.9	7,662	39.9
Active-duty family members	39,966	43.5	8,515	44.4
Retirees, family, survivors	28,978	31.6	3,008	15.7
Total	91,822	100.0	19,185	100.0

of the Medicare-DoD Senior Prime demonstration. Because some data from the guideline implementation at these MTFs were included in RAND's analysis of guideline effects, the facilities are briefly described here. The MTFs were Brooke AMC at Fort Sam Houston in Texas, Evans ACH at Fort Carson in Colorado, and Reynolds ACH at Fort Sill in Oklahoma. Brooke AMC is a 450-bed medical facility that includes operating rooms, oral surgery suites, dental treatment rooms, a diagnostic and therapeutic radiology center, a same-day surgery suite, and the requisite outpatient clinics and ancillary support services. Evans ACH is a 195-bed facility with medical and surgical inpatient units and primary and specialty care outpatient services. Reynolds ACH is a 150-bed hospital that provides primary care services through several clinics, as well as a range of specialty care and ancillary treatment services.

The RAND Evaluation

RAND's evaluation of the demonstration consisted of two components. The first component was an evaluation of the implementation process at two AMEDD sites and two of the three TRICARE Senior Prime sites using site visits and interviews. The site visits to the TRICARE Senior Prime sites were conducted by the Region 6 (which covers Texas and much of the Southwest) Lead Agent's office, using RAND's evaluation model. The second component was an analysis of the effects of the guideline on service utilization at the two AMEDD sites and three TRICARE Senior Prime sites. Baseline service utilization (prior to guideline implementation) was also assessed for comparison and to establish a benchmark for current practice. Service utilization was also assessed at five control sites to rule out the effects of temporal trends. Included in the analysis of service utilization was an assessment of the adequacy of Army medical databases for monitoring the results of the guideline implementation as well as future follow-up and provider feedback. The impact of the guideline on costs was also assessed.

Organization of This Report

In the remainder of the report, we present our evaluation methods and findings. Chapter Two describes the methods and data used for the evaluation. Chapter Three provides information on the size and characteristics of the diabetes population served by Army MTFs and profiles baseline performance for the MTFs included in the evaluation on each of the measures used to assess the effects of the guideline on clinical practices for diabetes patients. Results of the process evaluation are reported in Chapter Four, and results of the evaluation of guideline effects are presented in Chapter Five. In Chapter Six, we synthesize the results of the full evaluation and identify lessons learned and implications for systemwide guideline implementation strategies and also include our recommendations.

CHAPTER TWO

Methods and Data

The RAND evaluation of the diabetes guideline demonstration included two components: an assessment of the implementation process and an assessment of the effects of these implementation activities on delivery of care for diabetic patients. In this chapter, we summarize the methods and data for these two evaluation components. Additional details are provided in Appendix A.

Implementation of a clinical practice guideline is one type of quality improvement intervention. An evaluation of any quality improvement intervention should recognize the incremental nature of the processes of change, which require time to achieve lasting and measurable practice improvements. Therefore, a comprehensive evaluation of guideline implementation would recognize and assess three phases:

- **Introducing new practices.** Evaluating initial practice implementation efforts emphasizes documentation of the extent to which effective action plans are developed and the intended actions are actually implemented using process evaluation methods and (sometimes) feedback to participants.
- **Achieving intended changes in practices.** Evaluating process change involves monitoring short-term effects on service-delivery methods and activities using relevant, quantifiable outcome measures.
- **Improving patient (clinical) outcomes.** Assessing patient outcomes is a longer-term effort and also uses relevant, quantifiable

outcome measures. Patient outcomes were not assessed in this effort.

The data collected by RAND for the second phase of assessment were also used to assess the availability and usefulness of DoD administrative data for monitoring effects of practice improvement processes on clinical practices. In this analysis, we assessed which indicators could be measured using centrally available (administrative) data and which indicators required data currently available only at the MTFs. We also examined coding and measurement issues that must be addressed to establish valid measures of the indicators using the administrative data. We document our findings on these issues in Chapter Four.

Implementation Process Evaluation Methods

To learn from the experience of the MTFs participating in the demonstration, the RAND team used a participant-observer approach to exchange information and facilitate shared learning with the MTFs throughout the demonstration and evaluation process. The purposes of the implementation process evaluation were to

- document the actions and experiences of the demonstration MTFs with practice guideline implementation and assess performance relative to each of the six key success factors described in Chapter One;
- identify areas where the policies, systems, and processes established by the AMEDD for guideline implementation can be strengthened; and
- assess the degree to which demonstration sites might be able to build on their experiences with the demonstration guideline to implement additional DoD/VA guidelines.

Information was collected from the participating MTFs through a series of site visits, monthly progress reports prepared by partici-

pating MTFs, and questionnaires completed by individual participants. Additional details about these methods can be found in Appendix A.

Evaluation Site Visits

Three site visits were conducted at each demonstration site: an introductory visit before the kickoff conference and two postimplementation visits scheduled for the third and tenth month after the MTFs began implementing their action plans. The demonstration and evaluation schedule was as follows:

- November 1999—introductory site visits to demonstration MTFs.
- December 1999—kickoff planning meeting for MTFs.
- April 2000—first evaluation site visits three months after the MTFs began implementing their plans.
- October 2000—second evaluation site visits the tenth month of implementation.

In preparation for the site visits, RAND developed an agenda of the group meetings, individual interviews, and focus groups that we wanted to conduct. The facilitator of each implementation team worked with that agenda to schedule the meetings with implementation team members and other individuals involved in the implementation process.

MEDCOM staff participated in the site visits with the RAND evaluation team, which allowed MEDCOM to learn directly from the MTFs' experiences. RAND conducted the interviews and focus groups and the MEDCOM staff provided technical assistance and other support to the MTF teams. At the conclusion of each evaluation visit, we briefed the MTF command group about what we had learned and issues identified, which is a standard step for site visit processes at military facilities.

During the postimplementation site visits, we interviewed the guideline champion, team facilitator, and implementation team

members to learn their respective perspectives on the process and their experiences. Semistructured interview methods were used for all interviews and group discussions, working from predefined lists of questions to cover during each session. All individuals interviewed or in the focus groups were informed that the interviews were voluntary and, to protect their privacy, everything we reported from the evaluation would be designed so that individuals could not be identified as sources of comments or observations reported.

Focus groups were conducted with three stakeholder groups: the implementation team members, providers, and other clinic staff. All of the MTF champions and facilitators invited all individuals in each stakeholder group to participate in the focus groups. To give focus group participants the privacy to express their opinions freely, the implementation team did not attend the focus groups for providers or other clinic staff. At the start of each focus group, we advised the participants of the informed-consent provisions. We also described how this focus group fit into the overall site visit process, including the final outbriefing to the MTF command.

Using a written protocol, we asked participants in each focus group questions regarding their attitudes toward guideline implementation, how they worked with the practice guideline, how they were affected by the implementation process, and issues or concerns they had identified. There was good attendance and active discussion in the focus groups, giving us confidence that the feedback from the groups represented the sense of the various stakeholder groups.

Finally, we interviewed the command leadership of the MTF. These sessions allowed us to communicate issues to the leadership and to obtain their feedback on the practice guideline, the implementation process, and the level of priority placed on the work by the leadership.

Other Information Collection Activities

At the second postimplementation site visits (ten months into implementation), we began each interview or focus group by asking the participants to complete a written questionnaire that gathered information on individuals' views of the guideline and experiences in

the implementation process. Separate questionnaires were used for each of three groups: providers, other clinic staff, and the implementation team members. Because the number of respondents was small for each group, we could not analyze or interpret the results statistically. However, the survey information offered some insights into issues and experiences that were useful additions to the process evaluation.

The final source of process evaluation information was monthly progress reports prepared by the participating MTFs and submitted to RAND. These reports provided us valuable information on implementation progress over time, which we used in our preparation for the second postimplementation site visits. They also stimulated action by both the MTFs and MEDCOM because the MTFs identified issues requiring resolution.

Outcome Evaluation

The outcome analysis had four goals:

- Document the changes in clinical processes and service activity in the programs that implemented the practice guideline.
- Document changes in diabetic patients' service utilization that are attributable to the clinical process changes that have occurred.
- Assess average MTF costs of care for treatment of the diabetic patients they serve and how those costs may have been affected by implementation of the guideline.
- Examine the usefulness of the metrics and measurement methods used in the demonstration and implications for how best to establish an effective system for routine monitoring of ongoing progress.

Chapter One provided an exhaustive list of service outcomes that could be expected from implementation of a diabetes guideline. Aware that we could not assess all these potential changes, we identi-

fied a set of metrics that would provide a perspective broad enough to allow priority-setting for future quality and performance monitoring activities and stimulate improvements in data collection capabilities to permit measurement of important indicators of quality care. The hypotheses that generated our outcome measures are listed in Table 2.1. The outcome measures are discussed later in this chapter.

Evaluation Design

To test these hypotheses, we used an interrupted time series control-group design. Trends for the outcome measures were estimated for one year before the demonstration sites began using the diabetes guideline and for one year after its start date. This approach allowed us to estimate annual utilization measures, and it also controlled for any seasonal effects on diabetes care. A control group of five additional MTFs was used to adjust for underlying historical trends that otherwise could threaten the validity of findings at the demonstration MTFs. The evaluation design is shown in Figure 2.1.

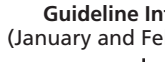
Choice of Demonstration and Control Sites

The demonstration sites were described in Chapter One. The five control MTFs were selected by MEDCOM and the Army's Patient Administration Systems and Biostatistical Activity (PASBA) to provide a reasonable match to the demonstration sites, based on peer

Table 2.1
Expected Effects of Proactive Diabetes Care Management

Short-term increases in the number of primary care visits per diabetic patient followed by a decline to stable visit rates *and*, early in the demonstration, a larger increase in the number of primary care visits per insulin-dependent patient than for those who are not insulin-dependent
Increase in the percentage of non–insulin dependent diabetic patients on oral hypoglycemic agents
Increase in the percentage of diabetic patients who had at least one eye exam annually
Decrease in the number of ER visits per diabetic patient
Decrease in the number of hospitalizations per diabetic patient

Figure 2.1
Evaluation Timeline



MTF Group	FY1999		FY2000				FY2001	
	April–June 1999	July–September 1999	October–December 1999	January–March 2000	April–June 2000	July–September 2000	October–December 2000	January–March 2001
Demonstration	B	B	B	B	E	E	E	E
Controls	C	C	C	C	C	C	C	C

NOTE: B = baseline period (study year one); E = experimental period (study year two); C = Control site conditions (no guideline introduction).
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groupings already established for benchmarking within AMEDD (based on size and service mix) and to ensure inclusion of sites that did not undertake initiatives to improve care for diabetic patients during the two-year study period.

Data Sources

The analyses conducted in this study required data on outpatient visits to primary care providers, visits to hospital ERs, hospital inpatient stays, use of medications for glycemic control, eye exams, and laboratory tests. Table 2.2 shows the sources of the data.

All of these data except the MEPRS data were extracted by PASBA, and the extracted data files were transmitted to RAND for analysis. Unit cost estimates based on the MEPRS data had been obtained by RAND directly from DoD as part of its evaluation of the Medicare-DoD Subvention Evaluation. Details of the methods for extracting data from these sources and for construction of the analysis files are presented in Appendix A.

The Diabetic Population

The total diabetic population ultimately addressed in this study consisted of all individuals who used an Army MTF for diabetes care at

Table 2.2
Sources of Data for Analyses

Data Type	Source
MTF outpatient visits	Standard Ambulatory Data Record (SADR) database extracted from MTF Ambulatory Data System (ADS) data
MTF inpatient stays	Standard Inpatient Data Record (SIDR) database extracted from MTF Composite Health-Care System (CHCS) data
Outpatient visits and inpatient stays for network providers	Health-Care Service Records (HCSR) database maintained in the TRICARE Civilian Health and Medical Program of the Uniformed Services (CHAMPUS) data system
MTF pharmacy data	Uniformed Services Prescription Database (USPD) maintained by the PharmacoEconomic Center
National Mail Order Pharmacy (NMOP) data	TRICARE NMOP data system
Laboratory tests	Triservice query of CHCS clinical chemistry laboratory data performed collaboratively by the Air Force's Population Health and Safety Division (PHSD), PASBA, and the National Maritime Intelligence Center
Financial data	Medical Expense and Performance Reporting System (MEPRS)[a]

[a] The DoD financial management data system that maintains facility-level financial data for all MTFs. This system uses a standard book of accounts to maintain records of operating costs, staff time and costs, and units of activities for each cost center.

least once during the two study years or resided in the catchment area of an Army MTF during that time. We identified this population based on information available in the service utilization data for MTF care or network provider care and in records of prescription medications filled by either MTF pharmacies or the NMOP program. A patient was identified as a diabetic patient if at least one record of any of the following types was found for the time period between January 1999 and March 2001:

- MTF encounter record with an International Classification of Diseases, Ninth Revision (ICD-9) diagnosis code for diabetes (code 250.xx) in any of the diagnosis code positions and care provided in an Army facility (all Army facility IDs including MTFs, clinics, and TMCs);

- network provider claim with an ICD-9 diagnosis code for diabetes (code 250.xx) in any of the diagnosis code positions and patient resided in the catchment area of an Army MTF or health center (parent facility IDs were used to pick up those residing in the parent facility catchment area, even if they used a freestanding clinic with a separate ID);
- at least one prescription filled at an Army MTF pharmacy that was on a defined list of diabetes medications (see Appendix A); or
- at least one prescription filled through the NMOP Program that was on a defined list of diabetes medications (see Appendix A) and the patient Zip code of residence was located within the catchment area of one of the Army MTFs or health centers.

We identified a total of 219,591 diabetic patients who were served by Army MTFs during the first year of this study and 232,123 patients who were served during the second study year. Additional details on the composition and demographics of these populations are provided in Chapter Three.

The sample sizes at the demonstration and control MTFs are presented in Table 2.3. For study year one, a total of 9,820 diabetic patients used one of the demonstration sites and 8,815 patients used one of the control sites at least once. Our study sample consisted of patients who were enrolled at one of the MTFs for the entire year. For the first year, the sample included 6,024 patients enrolled at one of the demonstration MTFs and 2,755 enrolled at one of the control MTFs. For the second year, the sample included 6,654 enrolled patients at the demonstration sites and 2,841 patients at the control sites (because individual patients were not followed, no attempt was made to determine degree of overlap in the samples).

Outcome Measures

The definitions used to calculate outcome measures are listed in Table 2.4. The first three definitions pertain to the first outcome measure listed in Table 2.1.

Table 2.3
Diabetic Patient Sample Sizes for the Demonstration and Control MTFs, by Study Year

	Study Year One		Study Year Two	
Enrollee Group	Demonstration Sites	Control Sites	Demonstration Sites	Control Sites
Total MTF users	9,820	8,815	10,552	8,683
Enrolled full year (study sample)	6,024	2,755	6,654	2,841
Other users	3,796	6,060	3,898	5,842

NOTE: "Enrolled full year" signifies beneficiaries who were enrolled in TRICARE Prime at this MTF for all of their inpatient and outpatient encounters in the SIDR and SADR records.

In addition to measuring performance on these indicators, we performed preliminary tests to assess the usefulness of the administrative data for measuring performance on several additional indicators for quality improvement monitoring. Our goal was to gain a better understanding of the completeness, validity, and reliability of the data for these measures. We examined the completeness of the first set of clinical laboratory records that DoD extracted from the CHCSs of all of its MTFs in 2001. We intended to use these records to measure performance of HbA_1c tests and lipid profiles. We then assessed the reliability and validity of recorded diagnoses, by first examining the consistency of diagnostic codes for each patient in the sample and second by comparing the coding of diabetes type (Type 1 and Type 2) on encounter records with pharmaceutical records of patients' use of insulin to manage their diabetes.[1]

Clinical Laboratory Records. The clinical laboratory data we obtained from PASBA were extracted from the Army MTF CHCSs for our study sample for June 2000 through June 2001. We report the results of our assessment of the clinical laboratory records in Table 2.5. The apparent increase in the number of laboratory

[1] The assumption was that only patients with diagnostic codes for Type 1 diabetes should have received prescription insulin and only patients with diagnostic codes for Type 2 diabetes should have received prescriptions for oral agents. Although Type 2 diabetics are sometimes treated with insulin, the extent of this practice is not known.

Table 2.4
Indicators Used to Measure Effects on Service Utilization Related to Implementation of the DoD/VA Diabetes Practice Guideline

	Calculation of the Indicator	
Indicator	**Numerator**	**Denominator**
Number of primary care visits per diabetic patient	Number of MTF primary care visits for patients in the denominator	Number of patients with diabetes ICD-9 code in the study year
Number of primary care visits per diabetic patient on insulin	Number of MTF primary care visits for patients in the denominator	Number of diabetes patients in the study year who had insulin prescriptions
Number of primary care visits per diabetic patient not on insulin	Number of MTF primary care visits for patients in the denominator	Number of diabetic patients in the study year without insulin prescriptions
Percentage of non–insulin dependent diabetic patients on medications to control hyperglycemia	Number of patients in the denominator with one control medication prescription[a] in the study year	Number of diabetic patients in the study year without insulin prescriptions
Percentage of diabetic patients who had at least one eye exam annually	Number of patients in the denominator with at least one eye exam during the study year	Number of patients with diabetes ICD-9 code in the study year
Number of ER visits per diabetic patient	Number of MTF ER visits for patients in the denominator	Number of patients with diabetes ICD-9 code in the study year
Number of hospital inpatient stays per diabetic patient	Number of hospital stays at MTFs or network hospitals for patients in the denominator	Number of patients with diabetes ICD-9 code in the study year

[a] The classes of diabetes control medications included are sulfonylureas, biguanides, thiazolidinediones, and meglitinides.

encounters over the year suggests that the data for early in the study period were highly incomplete. Therefore, we could not use these data for estimating numbers of HbA_1c or lipid measures.

Coding Diabetes Type. Using five-digit ICD-9 codes, we tabulated the relative frequency of coding for Type 1 and Type 2 diabetes on all encounter records (including outpatient and inpatient services by MTFs and network providers) for the patients in the first year

Table 2.5
Counts of Clinical Laboratory Records Extracted by DoD from the MTF CHCS Data, by Month and Year

Month and Year	Frequency	Percentage of Total
June 2000	1,511	1.9
July 2000	1,697	2.1
August 2000	2,893	3.5
September 2000	3,697	4.5
October 2000	3,427	4.2
November 2000	5,238	6.4
December 2000	4,090	5.0
January 2001	7,907	9.7
February 2001	8,492	10.4
March 2001	12,620	15.4
April 2001	13,816	16.9
May 2001	14,526	17.8
June 2001	1,806	2.2

sample.[2] The results of this analysis are reported in Table 2.6. We found that 36.8 percent of the patients were coded as Type 1 on some encounter records but as Type 2 on other records. For patients whose diagnosis was coded consistently on all encounter records, 3.0 percent were coded as having Type 1 diabetes and 60.0 percent were coded as Type 2 diabetes. The figure of 3.0 percent is lower than that reported by the CDC, which estimates that 5 to 10 percent of diabetics are Type 1 (CDC, 2001). However, the prevalence of Type 1 diabetes would be expected to be lower than average in this population.[3] Nevertheless, some of the patients who were coded inconsistently might actually have Type 1 diabetes. Thus, the percentage

[2] If the record had a diagnostic code of 250.01, 250.03, 250.13, 250.41, 250.43, 250.51, 250.53, 250.61, 250.63, 250.71, 250.73, 250.83, or 250.81, the record was coded as Type 1 diabetes. If a record had a diagnostic code of 250.00, 250.02, 250.22, 250.40, 250.42, 250.50, 250.52, 250.60, 250.62, 250.70, 250.72, 250.80, or 250.82, the record was coded as a patient with Type 2 diabetes.

[3] Type 1 and Type 2 diabetes are really two different diseases. The onset of Type 1 (formerly known as insulin-dependent diabetes mellitus) is typically childhood or adolescence; the prevalence of Type 1 in the population is estimated to be less than 1 percent; and Type 1 diabetes is a disqualification for military service. The onset of Type 2 (formerly known as non–insulin dependent diabetes mellitus) typically occurs in the early 40s or later, although that age is decreasing, and the prevalence of Type 2 is approximately 6 percent.

would increase if those patients could be identified accurately by the data, and our analysis confirmed that coding of diabetes type on encounter data does not provide reliable information.

Matching of Diabetes Type and Insulin Use. Based on our assumption that all Type 1 diabetic patients would use insulin and that no (or very few) Type 2 patients would use it, we checked use of insulin by reported diabetes type in the MTF and NMOP databases and found that the data were inconsistent, as also shown in Table 2.6. Although we did not have data from retail pharmacies, we estimated that they accounted for only a small fraction of insulin prescriptions. When we matched insulin use to diabetes type, as derived from the ICD-9 codes on service use encounters, we found that only 20.7 percent of the patients identified consistently as Type 1 diabetics had pharmacy records for insulin prescriptions, and 27.7percent of those with both Type 1 and Type 2 codes had insulin prescriptions.

These results reveal two separate issues in the administrative data that merit attention by MEDCOM. First, the very low percentage of Type 1 diabetic patients with insulin prescriptions indicates that the pharmaceutical data we were provided were incomplete. This issue raises a question about the accuracy of the data used to test trends for some of the indicators in this study, and it also poses a challenge regarding the validity of DoD administrative data for ongoing monitoring of diabetes management practices. Second, the percentage of inconsistently coded patients with insulin prescriptions suggests that

Table 2.6
Comparison of Diabetes Type Reported in Diagnostic Codes and Use of Insulin, Study Year One

Estimated Diabetes Type	Unknown	All Type 1 codes	All Type 2 codes	Both Types 1 and 2	Total
No insulin prescription					
Number of patients	19	207	5,084	2,334	7,644
Percentage	100.0	79.3	96.6	72.3	87.2
Prescription for insulin					
Number of patients	0	54	179	894	1,127
Percentage	0.0	20.7	3.4	27.7	12.9
Total number of patients	19	261	5,263	3,228	8,771

this group includes some Type 1 diabetics. These findings revealed the need to determine how best to achieve accurately automated records of diabetes types for ongoing monitoring of care and other management or quality improvement purposes.

Definitions of Other Key Variables

Variables for enrollment status, health-care service use, and medications were derived for calculation of the indicators being analyzed. We also defined variables for the gender, age, and insulin use status of each patient in our study sample. These variables are summarized here, and additional coding details are provided in Appendix A.

Enrollment Type. Two variables were derived and used to define enrollment status at a demonstration or control MTF. The first was a variable that identified whether a patient was ever enrolled at one of these MTFs or enrolled with a network provider but resided in the catchment area of one of the MTFs. The second variable identified whether the patient was continuously enrolled in the same place or changed enrollment during the relevant year. The enrollment type variables were also used to identify comparison populations for some of the analyses.

Patient Age. The variable for patient age was defined as the age of each patient at the end of each calendar year, which was calculated using the date of birth variable established on the master file. We also derived a categorical variable for patient age, which was used in some of the analyses. The age categories were less than 18 years, 18–44 years, 45–64 years, and greater than 65 years.

Insulin Use. A diabetic patient was identified as an insulin user if he or she had two or more insulin prescriptions in a study year. Insulin prescriptions included those for Humalog, Humulin, Iletin, Isophane, Insulatard, Lantis, Mixtard, Novolin, Relion, human insulin, beef insulin, pork insulin, Protamine zinc, or Velosulin.

Use of Primary Care Services. For each patient in the study sample, primary care visits were identified from the data in the SADR, which contains data for MTF visits. All visits for MTF family practice, internal medicine, pediatric, adolescent, other primary care, or flight medicine clinics were coded as primary care visits. A variable

was created with the number of primary care visits for each patient, and primary care visit rates were calculated as the sum of visits across all patients in a group divided by the number of these patients.

Use of Noninsulin Drugs for Glycemic Control. Any patient with one or more prescriptions for noninsulin glycemic control agents was defined as a person using noninsulin drugs to control HbA_1c levels. A prescription was defined as a noninsulin glycemic control drug if it was for one of the sulfonylureas, biguanides, thiazolidinediones, or meglitinides.

Eye Exams. Extender codes have been established in the ADS to record eye exams and foot exams for diabetic patients (V72.9__3 for foot exam and V72.9__4 for eye exam). However, these codes became available only after the demonstration, so none of the MTFs in this study could use them to document the exams. To determine numbers of eye exams, we identified visits at optometry or ophthalmology clinics, and any patient with at least one of these visits in a study year was coded as having an annual eye exam. To the extent that the new codes are used by the Army MTFs, these measures would be tracked in the future.

Use of ER Services. We were able to measure ER visits only for MTF ERs because we did not have the data needed to identify ER visits in the network provider outpatient data.[4] The ER visits probably are undercounted because of this missing data, but we believe that the undercount is small because most patients enrolled at an MTF are likely to use the MTF ER when they need such care. ER visit rates were calculated as the sum of visits across all patients in a group divided by the number of patients.

Hospital Inpatient Use. A variable was created for hospital inpatient stays, which included stays at MTFs and community hospitals that are network providers. Hospitalization rates were calculated as the sum of all inpatient stays across the patients in the sample divided

[4] There is a variable in the HCSRs that identifies the type of outpatient encounter, so it is possible to identify network provider ER visits. However, we had not obtained that variable in the network provider data for this study, so we had to work with only the MTF ER information.

by the number of patients. This variable was used to create a categorical variable (zero, one, or two or more stays) that was the dependent variable for the ordered logistic analysis to test trends in hospitalization rates.

Data Collection

An interrupted time series control-group design was used. To allow tracking of time trends, data were collected quarterly. Trends for the baseline measures were estimated for one year before implementation, and trends for the implementation outcomes were estimated for one year after implementation. This approach allowed us to estimate annual utilization measures and also controlled for any seasonality effects on diabetes care. Data from the control group of five additional MTFs were used to adjust for underlying historical trends that might confound the validity of findings at the demonstration MTFs.

Analytic Methods

The first step in the analysis was to calculate values for each indicator in each quarter-year of the study period. For each measure, we then estimated the baseline performance for the MTFs, described quarterly trends for the demonstration and control sites, and tested the statistical significance of any observed differences in performance of the demonstration site compared to the control sites. See Appendixes A and C for details on the statistical tests.

Baseline Benchmarking. Data from study year one were used as baseline measures for the five indicators. For each indicator, we compared the performance of each MTF to the mean performance of all other MTFs combined (i.e., excluding the index MTF). The baseline performance information for MTFs is reported in Chapter Three. We did not adjust for multiple comparisons, which can increase probability of Type 1 errors (false negatives). Although significance levels are reported for differences from the mean, the clinical significance of observed differences among MTFs needs to be considered when analyzing results, particularly for indicators where no guideline exists.

Descriptions of Trends for Indicators. To describe trend information, we prepared tables and graphs displaying estimates for the

indicators over the two study years, aggregated separately for the demonstration and control sites. In some cases, we found substantial differences in performance levels or trends between the demonstration sites or among the control sites. We examined the effects of these differences on overall trends by describing trends separately for each demonstration site or by describing aggregate trends for the relevant group of sites after excluding an MTF with outlying values. The quantitative results were compared to the implementation strategies of the demonstration sites to better interpret the observed trends. This step allowed us to assess the extent to which those strategies were reflected in observed service changes. These results are reported in Chapter Five.

Testing the Significance of Indicator Trends. The final step of the analysis was to test whether observed changes in service rates or medication use, if any, were large enough to be statistically significant, after controlling for temporal trends and for patient characteristics. For each indicator, we estimated a regression model with the dependent variable being the indicator of interest and the predictor variables, including a dichotomous variable for demonstration or control site, a set of dummy variables for the quarter-year periods, and variables for the patient characteristics.

To test for changes in outcomes during study year two at the demonstration sites, we also included one or more interaction terms for demonstration sites and each quarter of the intervention period. To determine the final specification of the interaction terms, we were guided by the observed trends in the measures and the significance of the coefficients on the interaction term for each quarter. The results of the analysis are presented in Chapter Five, and the specification of each model and detailed results of the modeling are reported in Appendix B.

Estimating the Costs of Care

The analysis of costs of care had two purposes: to gain an understanding of the costs MTFs incur for health care services for diabetic

patients and to evaluate whether introduction of the diabetes practice guideline affected those costs. The sample used for the analysis was populated by the patients served by the demonstration MTFs. To estimate the costs of care, MEPRS financial data were used to develop sets of unit costs for different types of inpatient and outpatient encounters. The relevant estimated unit cost was then applied to each unit of service in the SIDR and SADR encounter records (where each record represented one unit of service).

In developing our unit cost estimation methodology, our goal was to derive cost estimates that captured all MTF costs of care for inpatient or outpatient events and were sensitive to variations in the intensity of resources required to provide health care of different types. This cost estimation method was developed originally as part of the RAND evaluation of the Medicare-DoD Subvention Demonstration. Appendix A shows the details of the calculation of the unit costs and their application to each MTF inpatient and outpatient encounter record.

We designed the cost estimation methodology with technical consultation from SRA International, the TRICARE Management Activity (TMA) contractor that developed the Patient-Level Cost Allocation (PLCA) method used to design the financial provisions of the demonstration. The methodology we developed is an adaptation of the approach SRA took for developing the PLCA method.

For this cost analysis, we used cost and workload data for fiscal year (FY) 1998 that SRA generated for MTF outpatient clinics or inpatient wards for all Army MTFs included in this evaluation. The estimated unit costs included total direct and indirect expenses for each MTF cost center (ward or clinic), including direct expenses for staff time and supplies as well as indirect expenses for ancillary clinical services, administrative services, and maintenance and other support services.

We updated the unit costs to FY 1999 estimates by applying an inflation factor of 1.4 percent. These same unit costs were applied to encounters for both study years. By holding costs constant over time, any observed changes in costs between study years one and two can be attributed to changes in utilization. We tested two references for

Medicare cost increases to determine the 1.4 percent inflation rate (details in Appendix A).

Different unit costs were applied to each MTF encounter for different types of hospital inpatient stays (e.g., medical, surgical) or outpatient visits to different types of clinics. For a small percentage of clinics for which data were not sufficient to calculate clinic-specific cost estimates, we applied an MTF-average unit cost for outpatient services. Then we aggregated all encounters for each diabetic patient in the study to the patient level and used these aggregate costs to analyze per capita costs. Costs also were analyzed at the encounter level to assess the distribution of MTF costs between TRICARE Prime enrollees and other beneficiaries and to assess the extent to which costs are distributed between MTFs and network providers in the community. From the patient perspective, we examined the total, inpatient, and outpatient costs of care per patient for MTF services, looking separately at MTF enrollees and nonenrollees.

CHAPTER THREE

Diabetic Population and Practices at the Baseline

Because an understanding of the patient population and baseline performance of key care processes can influence the strategies chosen for implementation of care guidelines, we precede our report of the evaluation of the implementation strategy and outcomes with a description of the population served by the MTFs and the results of an analysis of baseline care processes.

Diabetic patients need ongoing care management. Therefore, TRICARE beneficiaries with diabetes are regular users of services covered by their TRICARE benefits. These services may be provided by MTFs or civilian network providers, depending on the patients' TRICARE enrollment status, proximity to an MTF, and the availability of needed services at the MTF. The primary patient population an MTF serves consists of TRICARE Prime enrollees for whom that MTF is their primary care manager. MTFs also serve patients who are not enrolled in TRICARE Prime or whose primary care manager is at another location but who need care while in the area or are referred from another MTF or network provider.

The Diabetic Population Served by Army MTFs

The Army MTFs served close to 230,000 diabetic patients during the first (baseline) year of our study. Table 3.1 shows the percentages of diabetic patients identified by using each of the encounter data

Table 3.1
Identification of the Diabetic Population Served by Army MTFs, by Study Year

	SIDR/SADR	PEC Pharmacy	Network Provider	NMOP	Total
Study year one					
Army active-duty	1,745	654	12	[a]	2,411
Army family member	12,106	21,323	1,920	[a]	8,179
Army retired	11,561	20,562	2,553	[a]	35,349
Retired family member	12,569	118,567	7,840	[a]	34,676
Other services	4,479	2,955	745	[a]	138,976
NMOP only	[a]	[a]	[a]	9,300	9,300
Total patients, year one	42,460	164,061	13,070	9,300	228,891
Percentage of total	18.5	71.7	5.7	4.1	100.0
Study year two					
Army active-duty	1,621	717	28	[a]	2,366
Army family member	4,297	3,204	555	[a]	8,056
Army retired	12,299	22,766	1,853	[a]	36,918
Retired family member	11,635	22,206	2,380	[a]	36,221
Other services	12,635	128,777	7,150	[a]	148,562
NMOP only	[a]	[a]	[a]	10,117	10,117
Total patients, year two	42,487	177,670	11,966	10,117	242,240
Percentage of total	17.5	73.4	4.9	4.2	100.0

[a]NMOP claims did not have data on the military status of beneficiaries, so we could not classify any patients who were identified only through NMOP claims.

sources. For study year one, 18.5 percent of the patients were identified using the SIDR and SADR data, and another 71.7 percent (for whom there were no SIDR or SADR records) were identified through the PEC pharmacy data. The network provider data added only another 5.7 percent, and the NMOP data added the remaining 4.1 percent. Similar percentages were found for study year two. More than half the diabetic patients were active-duty personnel, retirees, or family members of services other than the Army. Among those affiliated with the Army, all but a small fraction were either retired Army personnel or family members, and, given the nature of the diseases, it is not surprising that only a small proportion of diabetics were active-duty Army personnel (2,411 in study year one; see Chapter Two).

The demographic characteristics of the diabetic patients, reported in Table 3.2, reflect their military status. Overall, 42.8 per-

cent of the patients in study year one were 45 to 64 years of age and 46.2 percent were 65 years of age or older. The percentages were similar for study year two. These percentages closely match those for retired personnel and family members, who constitute the majority of diabetic TRICARE patients. The active-duty personnel and family members with diabetes have a younger age distribution.

Enrollment Status and Use of MTF Services

The enrollment status of diabetic patients seen at MTFs was also examined, for two reasons. First, MTFs should be able to manage

Table 3.2
Demographic Characteristics of the Diabetic Population Served by Army MTFs, by Study Year

	All Patients	Army Active-Duty	Army Family Member	Army Retired	Retired Family Member	Other Services	NMOP Only
Study year one							
Distribution by age							
Total	228,883	2,411	8,176	35,349	34,676	138,971	9,300
Less than 18 years[a] (%)	1.4	0.2	11.1	0.0	1.1	1.3	0.6
18–44 years (%)	9.7	66.3	53.4	2.6	5.5	9.4	3.7
45–64 years (%)	42.8	30.2	21.9	42.9	46.3	43.1	45.1
65+ years (%)	46.2	3.3	13.6	54.5	47.1	46.2	50.7
Distribution by gender							
Male (%)	50.2	77.1	12.1	98.7	1.9	51.6	51.5
Study year two							
Distribution by age							
Total	242,239	2,366	8,056	36,918	36,221	148,561	10,117
Less than 18 years[a] (%)	1.2	0.2	9.1	0.0	0.9	1.1	0.6
18-44 years (%)	9.4	65.0	53.9	2.3	5.0	9.3	3.0
45-64 years (%)	41.6	31.0	22.6	42.5	45.1	41.7	41.5
65+ years (%)	47.9	3.8	14.3	55.2	48.9	47.9	54.8
Distribution by gender							
Male (%)	50.1	76.2	11.1	98.7	1.9	51.5	50.1

[a]The finding of active-duty personnel under age 18 may represent an error in the records.

care more effectively for their own enrollees than for intermittent users who also may be obtaining care from local network providers or other MTFs. For this reason, the MTFs should be held accountable first for care of their own enrollees, and any performance-monitoring system should use measures calculated specifically for this population. Second, for accurate calculation of performance measures, all care obtained by a patient population of interest should be taken into account. For example, hospitalization rates would be undercounted if hospital stays in community (nonmilitary) hospitals were excluded from the counts used to calculate these rates.

Our analysis revealed the importance of using both MTF service encounter data and network provider claims to gain a full understanding of service use patterns. As shown in Table 3.3, 61.8 percent of MTF outpatient or ER visits were provided for members of the diabetic patient population who were enrolled in TRICARE Prime at those MTFs. Another 37.6 percent of the visits were for patients not enrolled at the MTF,[1] and fewer than 1 percent of services were for patients enrolled with network providers. In contrast, virtually all inpatient care provided by MTFs was for their own enrollees.

Network providers had a different pattern of service provision. An estimated 67.9 percent of network outpatient and ER visits were provided to patients enrolled in TRICARE Prime with network providers. Another 15.8 percent were for patients enrolled at MTFs, and 16.2 percent were for nonenrollees. A different distribution was found for network provider inpatient services, with 11.4 percent provided to MTF enrollees, 43.7 percent to network provider enrollees, and another 44.9 percent provided to nonenrollees.

These data are also shown graphically in Appendix C. The data show that services provided to nonenrollees represent a substantial

[1] The population of nonenrolled patients includes a large percentage of individuals over 65 years of age who are eligible for Medicare as well as DoD health benefits. Because Medicare is their primary payer, these patients have access to MTF services only on a space-available basis.

Table 3.3
Enrollment Status for Patients Receiving Diabetes Care at Army MTFs or Network Providers, by Study Year

	Diabetes Outpatient/ ER Visits		Diabetes Admissions	
	Number of Encounters	Percentage of Total	Number of Encounters	Percentage of Total
Study year one				
Service at MTFs				
Prime enrolled at the MTF	102,709	61.8	8,451	98.9
Prime enrolled with a network provider	1,011	0.6	90	1.1
Not enrolled	62,419	37.6	1	0.0
All patients	166,139	100.0	8,542	100.0
Service at network providers				
Prime enrolled at an MTF	17,309	15.8	549	11.4
Prime enrolled in network	74,278	67.9	2,111	43.7
Not enrolled in Prime	17,739	16.2	2,166	44.9
All patients	109,326	100.0	4,826	100.0
Study year two				
Service at MTFs				
Prime enrolled at the MTF	125,446	67.2	8,405	98.5
Prime enrolled with a network provider	1,033	0.6	125	1.5
Not enrolled in Prime	60,174	32.2	5	0.1
All patients	186,653	100.0	8,535	100.0
Network provider service				
Prime enrolled at an MTF	18,865	19.9	690	14.1
Prime enrolled in network	61,971	65.3	2,194	44.7
Not enrolled in prime	14,033	14.8	2,019	41.2
All patients	94,869	100.0	4,903	100.0

share of MTF health care resources. The data also show that MTF enrollees use a mix of MTF and network provider services, so all services must be counted to obtain accurate estimates of health-care use rates.

Baseline Performance on Diabetes Care Measures

The number of diabetic patients who used each of the demonstration and control sites is reported in Table 3.4. These data include separate counts of all patients who used each MTF at least once during each

Table 3.4
Diabetic Population Using the Demonstration and Control MTFs, by Study Year

	Study Year One		Study Year Two	
Study Site	Any Use	Enrolled Full Year	Any Use	Enrolled Full Year
Demonstration sites				
Demo 1	3,303	2,178	3,635	2,428
Demo 2	258	111	249	128
Demo 3	4,132	2,149	4,039	2,216
Demo 4	899	680	1,031	825
Demo 5	1,228	906	1,598	1,057
All Demos	9,820	6,024	10,552	6,654
Control sites				
Control 1	3,021	1,339	3,056	1,429
Control 2	695	159	625	96
Control 3	3,585	351	3,643	367
Control 4	867	489	864	591
Control 5	647	417	495	358
All Controls	8,815	2,755	8,683	2,841

NOTE: "Enrolled full year" signifies beneficiaries who were enrolled in TRICARE Prime at this MTF for all of their inpatient and outpatient encounters recorded in SIDR and SADR.

study year and of the subset of patients who were enrolled at the MTF all year, as indicated by enrollment status codes on the encounter records. Overall, enrollees represented a larger proportion of total diabetics seen at the demonstration sites than did enrollees at the control sites (almost 60 percent versus less than 35 percent). Two control sites with larger numbers of patients were important sources of this difference, but the difference was also found for smaller control sites.

We calculated average baseline values for the five indicators of guideline effects for the baseline time period—April 1999 through March 2000—for each of the ten MTFs included in the study. We also calculated an overall average as a benchmark against which each MTF was compared. These ten facilities represent approximately one-quarter of the Army MTFs, with respect to patient population served.

These baseline comparisons are diagnostic tools that show the extent of variation across facilities in the provision of diabetes services and highlight particular facilities or aspects of care that merit targeted intervention for strengthening practices. The direction provided by

the DoD/VA diabetes guideline should be considered when interpreting the baseline performance data and formulating quality improvement interventions for diabetes care.

As shown in Table 3.5, the guideline places an emphasis on early and ongoing care management for diabetes, including careful control of glycemia (as measured by HbA_1c levels) as well as regular screening for signs of such organ system complications as neuropathy or effects on vision. Thus, well-managed patients should make regular visits to primary care providers for management of their diabetes. Similarly, high percentages of patients should have at least one eye examination annually to check for early symptoms of vision problems. Wide variation across MTFs on any given measure suggests that MTFs may not be providing care consistently, which could include overtreatment in some cases and undertreatment in others.

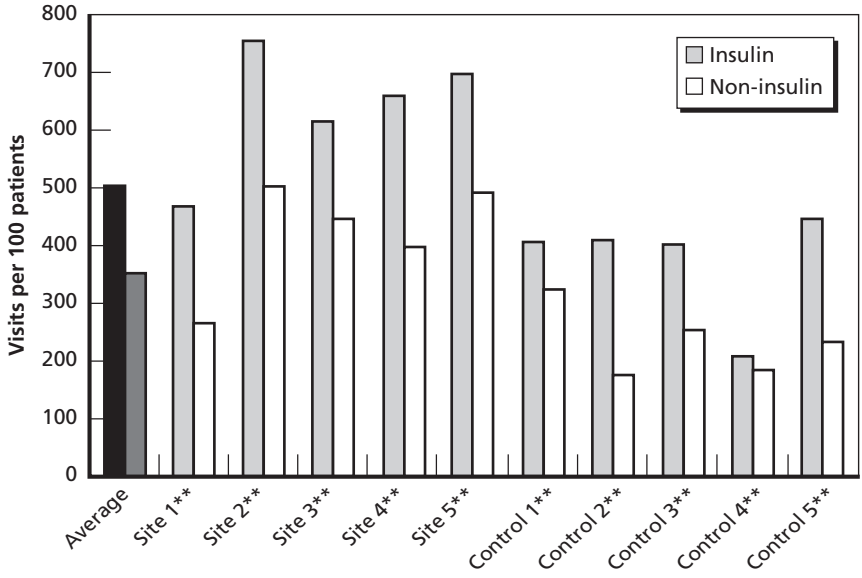
Distributions of MTFs on Diabetes Measures

Figures 3.1 through 3.5 show the baseline performance of the study MTFs on the six indicators of diabetes care. The first bar on the left of each graph is the overall average baseline performance for all ten MTFs, and the remaining bars show the values for each of the MTFs, numbered to protect confidentiality. Asterisks following the site number indicate a significant difference in performance from the average for the other MTFs (** for p less than 0.01).

Table 3.5
Rationale for Diabetes Indicators Provided by the Guideline

Indicator	Guideline Direction
Primary care visits	Monitor patients' glycemic status and organ systems regularly. Low visit rates may indicate inadequate care management.
Oral hypoglycemic agents for patients not using insulin	Perform proactive tests for glycemic control; prescribe and adjust oral agents as indicated by results.
Annual eye examinations	Conduct an eye examination annually, more frequently if indicated, to prevent complications.
ER visits	Ensuring effective care management should reduce rates of use of ER care.
Hospital inpatient stays	Ensuring effective care management should reduce need for inpatient care.

Figure 3.1
Baseline Annual Primary Care Visits per 100 Diabetes Patients for Insulin and Non–Insulin Users, Total and by Site



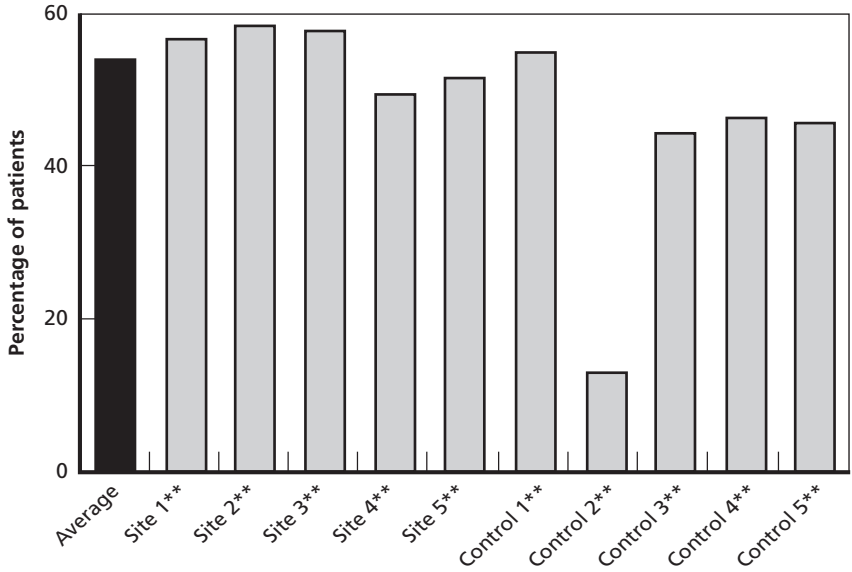
**p = less than 0.01.

RAND *MG277-3.1*

Primary Care Visits. The average rates of primary care visits for diabetic patients who use insulin as well as patients who do not use insulin reveal substantial inter-MTF differences, all of which are statistically significant (Figure 3.1). The visit rates for insulin users were higher than those for non–insulin users for all the MTFs, although the differences between them vary across MTFs. Visit rates for insulin users ranged from fewer than 200 visits to more than 750 visits per 100 patients, while those for non–insulin users ranged from fewer than 200 to more than 500 per 100 patients.

Use of Oral Hypoglycemic Agents. The baseline percentages of non–insulin using patients on these agents ranged from 40 to 60 percent for all the study sites, except for one control site with a level of approximately 10 percent (Figure 3.2). This figure suggests that phar-

Figure 3.2
Baseline Percentages of Non–Insulin Using Diabetic Patients Treated with Oral Hypoglycemic Agents, Total and by Site



**p = less than 0.01.

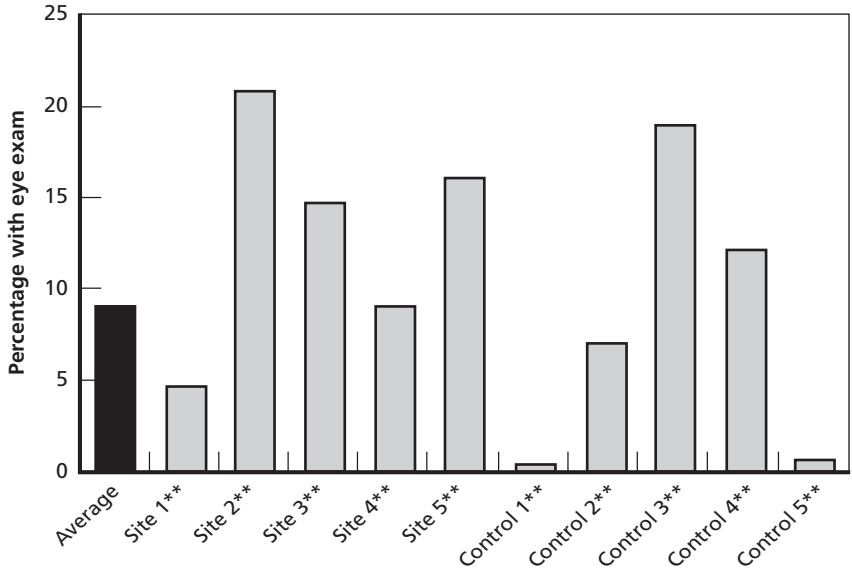
RAND *MG277-3.2*

maceutical data reported for this site may have been incomplete. All differences observed across the sites were statistically significant.

Annual Eye Exams. The percentage of diabetic patients who had at least one eye examination during the baseline year varied substantially across study sites (Figure 3.3). Two control sites showed very low percentages, which may reflect missing data. Values for the remaining sites ranged from approximately four percent to greater than 20 percent, and the differences across MTFs were statistically significant. The DQIP standard for annual eye exams is 100 percent.

ER Visits and Hospitalization Rates. Substantial and statistically significant variation was observed across MTFs for both ER visits (Figure 3.4) and hospitalization (inpatient stays) (Figure 3.5). Several MTFs with higher rates of ER visits had lower rates of hospitalization while some with lower rates of ER visits had higher hospitaliza-

Figure 3.3
Baseline Percentage of Diabetic Patients with at Least One Eye Examination Annually, Total and by Site



**p = less than 0.01.

RAND *MG277-3.3*

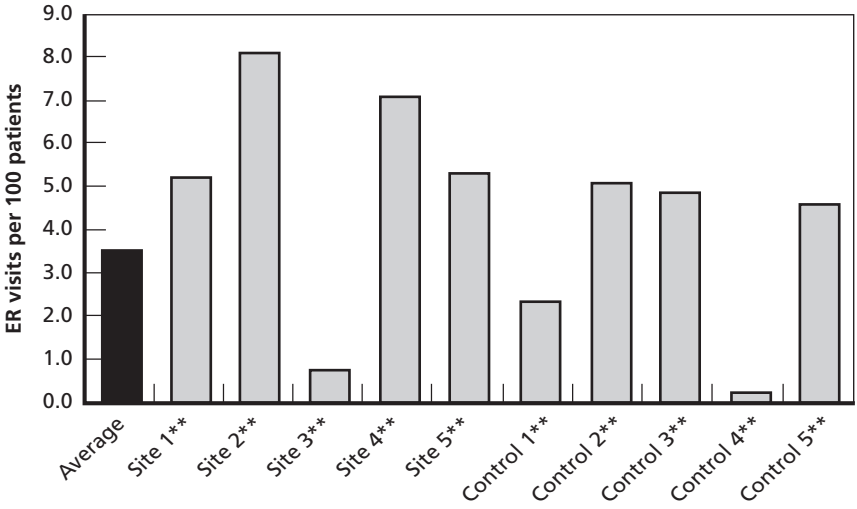
tion rates. Missing data may also be a concern for these measures because two MTFs showed quite low ER visit rates and one MTF had unexpectedly low rates of hospitalization.

Summary

The baseline data analysis produced the following findings:

- The diabetic population served by Army MTFs is large, primarily consisting of older, Type 2 diabetics (retirees from all services and their dependents).
- The majority of diabetic patients served by the MTFs were TRICARE Prime beneficiaries for whom that MTF was their

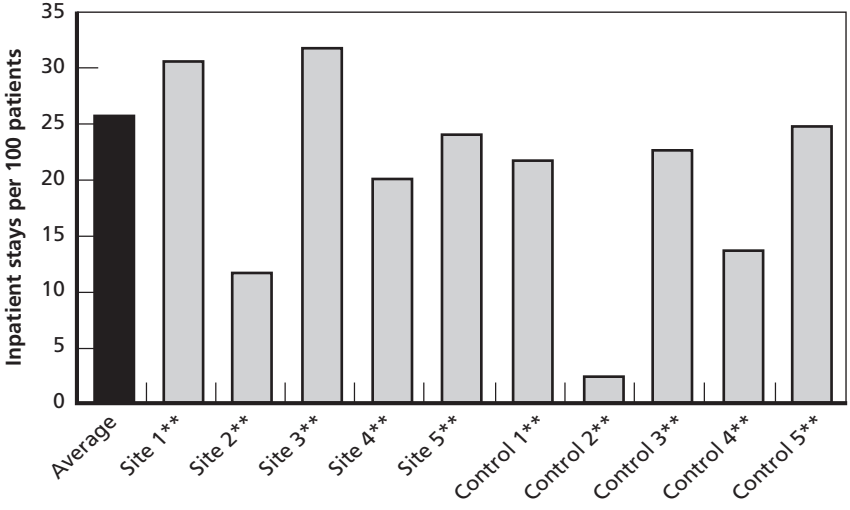
Figure 3.4
Baseline Annual ER Visits per 100 Diabetic Patients, Total and by Site



**p = less than 0.01.

RAND *MG277-3.4*

Figure 3.5
Baseline Annual Inpatient Stays per 100 Diabetes Patients, Total and by Site



**p = less than 0.01.

RAND *MG277-3.5*

primary care manager. Nevertheless, a substantial proportion of diabetic patients seen at the MTFs were enrolled at other facilities (MTFs or civilian network sites). These patients would be expected to receive at least some of their diabetic care at their site of enrollment and might account for some of the low measures on the five indicators.

- Significant differences were observed across the sites in the baseline values for each of the five care indicators. However, the importance of these differences depends on how the actual performance at each site varies from recommended guidelines, where applicable.
- Some low measures suggested incomplete data.
- The baseline comparisons can be used as benchmarks to detect differences across facilities and to identify areas where practice improvement efforts may be needed.

CHAPTER FOUR

The Guideline Implementation Process

The diabetes guideline demonstration was the third test of an implementation approach that coordinated actions at the corporate (MEDCOM) and local (MTF) levels to achieve best practices. MEDCOM defined the desired clinical practices (as specified in the DoD/VA practice guideline) and key metrics to measure attainment of those practices, provided tools to assist the MTFs as they introduced new practices in response to the guideline, and facilitated MTF guideline implementation through site visits as well as e-mail and phone communication. The practice changes were carried out by the MTFs, as the health-care delivery organizations. The MTFs were offered the flexibility to define strategies and clinical process changes within the context of their respective missions, populations, and administrative and clinical assets. Because these characteristics differed across facilities, we expected to observe differences among the MTFs' implementation strategies and the pace at which they introduced practice changes.

This chapter reports the findings of the implementation process evaluation in terms of the infrastructure established for the diabetes guideline demonstration and the strategies and actions undertaken by the MTFs to implement best practices for management of diabetes patients. We first describe the MEDCOM support structure and activities, followed by a description of the MTF environment and support structure for guideline implementation at the participating MTFs. Then we describe the strategies and actions the MTF teams identified in their implementation action plans. Finally, we summa-

rize the lessons learned from the experiences of the MTFs participating in this demonstration.

RAND's process implementation evaluation was conducted at the two AMEDD demonstration MTFs. A summary of the process evaluation conducted for two of the three TRICARE Senior Prime demonstration sites is also included at the end of the chapter.[1]

MEDCOM Support

The corporate responsibility for operating the AMEDD program for evidence-based practice guidelines was assigned to the MEDCOM Quality Management Directorate. Initially, the staff for this new initiative consisted of a full-time program director and a secretary. By the time the diabetes guideline demonstration began, the MEDCOM program staff had been expanded with the addition of three full-time guideline representatives who supported MTFs in implementing the three demonstrations as well as other practice guidelines being implemented across the AMEDD system.

The diabetes practice guideline demonstration had the advantage of building on the lessons learned from the low back pain and asthma guideline demonstrations. These lessons were shared with the participating MTFs during the kickoff conference and throughout their work during the demonstration. The MEDCOM staff continued to be committed and highly motivated, and they worked collaboratively with the MTF teams in these development efforts.

MEDCOM supported the MTFs in implementing the diabetes practice guideline by organizing an offsite kickoff conference to introduce the implementation teams to the guideline and help them develop implementation action plans, providing the MTFs with a toolkit of items to support guideline implementation, providing information systems support to the demonstration sites, and facilitating communications between MTFs and MEDCOM and provid-

[1] We did not have access to the notes from the site visit to the third facility.

ing technical support to the MTFs. We describe our findings regarding each of these components.

The Kickoff Conference

The implementation teams gathered for two days on December 2–3, 1999, in Tacoma, Washington, to prepare for implementation of the guideline. Upon arrival at the conference, participants were given a notebook containing information on the guideline, toolkit items, and instructions for preparing an implementation action plan. The conference began with a half-day plenary session at which the diabetes guideline was introduced and instructions for action plan development were provided. For the remainder of the conference, the teams met separately and prepared their strategies and action plans for implementing the guideline at their facilities. Each MTF team had designated a facilitator who guided the team through a four-step planning process developed by RAND, using a set of worksheets for preparation of the action plan document. The MTF teams briefed the representative of regional command on their action plans at the end of the conference.

One of the lessons from past experience was the importance of having all materials completed and ready for the participating MTFs by the time the kickoff conference began. Delays in previous demonstrations in providing toolkit materials and key metrics—and in one case the guideline itself—made it difficult for the MTFs to begin working with the guideline as quickly as they had hoped. For the diabetes kickoff conference, MEDCOM had completed the final practice guideline, list of key guideline elements, key metrics for monitoring, and the guideline toolkits. These materials were distributed to the participating MTFs before and during the demonstration kickoff conference.

The Diabetes Toolkit

In preparation for the diabetes practice guideline demonstration, MEDCOM and CHPPM convened a toolkit workshop on September 9, 1999. At this workshop, tools were developed to assist Army MTFs in working with the diabetes practice guideline. Four work

groups operated during the workshop, each with responsibility for one group of tools: provider support tools, patient self-management support tools, and system support tools for electronic health systems as well as nonelectronic record systems. Using the products generated by the workshop teams, MEDCOM and CHPPM then prepared the core set of items to be included in the initial diabetes practice guideline toolkit. The tools included in the kit are shown in Table 4.1. They were tested by the demonstration MTFs.

The tools identified at the workshop for operational support and information systems were not "physical" items as such, but entities such as patient self-monitoring system(s), a model disease management program, and methods for educating clinic staff on the guideline and related practices. Work on these tools continued within MEDCOM and CHPPM. Information systems tools also were pursued, including an automated SF600 form (the Chronological Record of Medical Care, the federal government's standard medical form), several options for a diabetes registry, and methods for identification of at-risk patients from automated databases.

Feedback on the Toolkit. During the first postimplementation site visits, feedback was obtained on the toolkit items. In response to the feedback, MEDCOM and CHPPM revised the tools. By the second site visit, the MTFs had received most of the revised toolkit items as well as some newly developed tools that had been requested in the first site visit. The feedback was particularly helpful because it represented the contrasting views of a large, specialty facility and a small, remote community hospital.

Table 4.1
Contents of the Diabetes Toolkit

Provider Support	Patient Self-Management Support
Encounter documentation (Form 705-R)	Action plan workbook
Diabetes flow sheet (Form 706-R)	Patient education booklet
Guideline key elements reminder card	Patient education video
Pocket-size reminder card	
Provider education briefing slides	

Encounter Documentation Form. Standardized documentation methods are intended to ensure that all the key information required for management of diabetes care is efficiently entered into the patients' medical charts. To this end, documentation form 705-R and diabetes flow sheet 706-R were developed for the diabetes toolkit.

The documentation form included three sections: one to be completed by the patient, one to be completed by the clinic staff, and one to be completed by the physician. At our first site visits, both MTFs reported that they were not using this form because they had identified several problems with it. Problems identified included language in the patient section too complex for patients to understand, lack of space for laboratory results and medications prescribed, and lack of space for write-ins. One MTF chose to use the form 705-R with modifications, and some providers in the MTF used the flow sheet 706-R. The other MTF chose not to use either form because the staff had concerns about facing too many forms if they used a separate form for each practice guideline being implemented. Instead, they decided to continue to use the SF-600 form to document care, with specific information for diabetes patients printed on it. One MTF had developed a modified form to replace the MEDCOM form.

Both MTFs also identified the difficulty of working with this type of documentation form for patients with multiple diagnoses because the form is designed to address only one condition. This issue has surfaced in all three of the practice guideline demonstrations. It appeared to be especially difficult with diabetes because providers reported that most diabetic patients have multiple diagnoses, and the form does not have enough space to write about all of them.

Diabetes Flow Sheet. In general, positive feedback was received on the flow sheet, including comments that it provided a good memory log of care over time. Some concern arose about the time required to complete the sheet. In addition, staff members were unclear about where to file the sheets in the charts, and as a result, the sheets were not easily found and retrieved. Some providers readily began to use the sheets while others chose not to use them.

Provider Education Briefing Slides. Few comments were given on the provider briefing, which was an adaptation of the kickoff conference practice guideline briefing. This tool apparently had little use.

Reminder Cards on Guideline Key Elements and Coding. These cards were accepted as containing useful information for providers. They were seen as particularly useful for residents, who move frequently. Few comments were offered for revisions.

Patient Education Booklet. Both MTFs offered negative feedback on the booklet. They reported that it was too bulky, too busy, and written at too high a reading level. Further, the content was not detailed enough to give patients needed information. At one MTF, patients reportedly did not like the tear sheet in the booklet. Suggested revisions included bringing the text to the fifth-grade reading level and creating separate handouts for each topic.

Patient Education Videos. The videos were viewed as acceptable by the MTFs, although one MTF did not use the adult video because they considered the content too basic. A clinic that was part of the other MTF did not use the video because it lacked the equipment needed to show it.

Additions to the Toolkit. It was suggested that an education program be developed for clinic staff that would cover various processes to support effective diabetes care. Items that needed to be covered included foot exams, use of equipment, taking blood pressure, patient education, chart review methods, and ICD-9 coding.

One of the MTFs had developed several additional patient-support tools that could be shared with other MTFs. These items included posters on foot care, use of monofilaments to test for peripheral neuropathy, and diabetes complications.

Information Exchange

Two mechanisms were established to help the MTFs share their implementation experiences and learn from each other during the demonstration—a listserv operated through the AMEDD e-mail system and ongoing interactions with and feedback from MEDCOM during the demonstration (which continued after the demonstration was complete as a routine part of MEDCOM support). Again draw-

ing on lessons from previous demonstrations, the demonstration participants on the listserv were a small number of people from each demonstration MTF who served as liaisons between MEDCOM and the local MTF implementation teams. In addition, the MEDCOM guideline office staff, national diabetes guideline champions, RAND team members, and other interested parties were included.

MEDCOM conducted periodic teleconferences or videoconferences to communicate with the sites during the demonstration. MEDCOM staff also participated in the two rounds of site visits for the RAND evaluation, during which they were able to address questions from the sites and more generally assist them in their implementation activities. In addition to these organized encounters, MEDCOM staff were in regular contact with staff at the demonstration MTFs, and one staff member had designated responsibility to support implementation of this guideline.

Structure and Support at the MTFs

The MTF Environment

The two demonstration MTFs differed substantially in their sizes, clinical capabilities, previous quality improvement activities, and use of clinical practice guidelines. Both sites had the basic clinical capabilities for the treatment of diabetes, including primary care clinics, patient education resources, and at least some relevant specialty care. The extent of total staffing resources available to undertake this initiative, however, was a big factor in their ability to implement new processes and systems. The unique features of the two MTFs influenced the strategies and actions chosen by their teams for implementing the diabetes practice guideline.

As a small, remote facility, Bassett ACH was understaffed with respect to the ratio of support staff to providers, and it was located at a distance from specialized medical and surgical resources. Virtually all care for diabetic patients was provided in the internal medicine clinic, where the guideline implementation activities were undertaken. An emphasis was placed on establishing stringent standards to

control patients' diabetes because of the geographic barriers to obtaining specialized care for diabetic complications.

Madigan AMC is a large facility that serves as one of the specialized regional resources for the more remote facilities. The adult primary care clinic and family practice clinic saw most of the diabetic patients, and both clinics were involved in the demonstration. Reflecting its scope of resources, Madigan took a comprehensive approach to intervene at various stages of diabetes management, with the goal of improving performance on the DQIP indicators for glycemic control and tests for complications. Before this demonstration, Madigan had been an active member of a statewide diabetes initiative.

Support for the Demonstration

To prepare for implementation of the diabetes guideline, commanders of the demonstration MTFs were requested to appoint a multidisciplinary implementation team of eight to ten individuals who represented the mix of clinical and support staff involved in delivering care for patients with diabetes. This team size has been shown to be optimal for effective team operation. The implementation team was given the responsibility to develop an action plan for strengthening diabetes care and to facilitate its implementation.

The commanders also were requested to designate a guideline champion and a facilitator to lead the implementation activities. The champion was the leader of the implementation activities and the MTF team. The facilitator was to guide the implementation team in developing an implementation action plan and then was to provide support to the champion and team in coordinating and managing the implementation process.

Command Support and Accountability. Commanders at the demonstration MTFs agreed to participate in the diabetes guideline demonstration. The support of the MTF commanders continued over the life of the demonstration, despite an extensive turnover of command staff at one of the facilities. In addition, staff at the lead agent office of TRICARE Region 11 were highly supportive of the demonstration, including participation in the kickoff conference and both sets of site visits during the process evaluation. Their goal was to

learn from this process so it could be implemented more broadly across facilities in the region.

After the MTF commanders designated guideline champions, facilitators, and implementation teams, they authorized the teams' participation in the two-day offsite conference that initiated the demonstration. However, none of the leaders or members of the teams were formally given dedicated time to devote to carrying out the guideline action plan. Rather, it was assigned as a duty in addition to other tasks, which one team referred to as "an invitation to failure."

The implementation teams at both MTFs reported regularly to their commands. At one MTF, the champion reported directly to the MTF leadership. At the other, the activities were reported as part of the clinical standards reports to the executive board of directors, consisting of the MTF clinical leadership. Such an emphasis on regular reporting establishes accountability for progress in implementing improved diabetes clinical practices. At the second round of site visits, both MTF commanders made clear statements in support of improved diabetes practices, and they responded to issues identified during the site visit with directions to staff to address the problems and report results to them.

The Champions. The champion at one MTF was an internist, and the champion at the other MTF was an endocrinologist (Madigan actually employed two champions, one for each of the clinics). Both made strong commitments to this role and invested substantial time in leading the work on implementing their diabetes action plans. Both champions had to fit their demonstration responsibilities into already heavy schedules. They saw the need to have one person dedicated to such an effort with responsibility to seeing that the defined actions are taken. One of them reported that a champion needs to work effectively with providers, understand the subject matter, and know the process of care being used.

The Facilitators. Both demonstration MTFs had facilitators who had been actively involved in the implementation process since before the kickoff conference. One facilitator was a nurse case manager and the other was pathway coordinator. These individuals took lead roles in coordinating the activities and tracking measures of performance.

The Implementation Teams. Both MTFs established teams that included the appropriate clinical and support staff, including primary care providers and nursing, plus other types of staff. When available, pharmacy, health education, and podiatry also were represented on the teams. One MTF started with a 20-member team that met on an as-needed basis, communicating between meetings by e-mail and informal conversations. They found this group was too large to coordinate effectively and meet on a regular basis, and they allowed attrition to reduce the team size and composition. The other MTF had a small team of four or five persons that worked together informally without scheduling many official meetings.

Implementation Activities and Progress

The implementation of the diabetes guideline began in early April 2000.

Implementation Strategies

At the kickoff conference, the teams were encouraged to approach implementation by undertaking actions on a small scale first, through which they could gain experience and correct problems identified before launching a major change in practices across the organization. Both MTFs took this approach, working with one or two clinics within their facilities to improve practices for care of diabetes patients. However, their approaches to introducing practice changes differed greatly, reflecting the substantial differences in the two MTFs.

One MTF defined a comprehensive action plan with four main components designed to enhance effective management of diabetes patients: establish and maintain a diabetes registry to track key DQIP measures, empower the ancillary staff through education to effect change in patient care, employ marketing strategies to set realistic patient and provider expectations regarding diabetes care, and streamline diabetic assessment and management through use of algo-

rithms and standardized documentation of care. Implementation began with one or two health-care teams in each of two clinics.

The other MTF planned to optimize patient management and reduce variability in provider practices for diabetes care, with the goal of standardizing care across its facility and the VA facility with which it works. To achieve this goal, patients were to be intimately involved in their own care. Implementation was focused in the internal medicine clinic, which sees 80 percent of the diabetes patients.

The Implementation Process and Activities

To carry out their respective strategies, the sites introduced the guidelines algorithm and supporting toolkit items to providers and staff, sought to make changes to administrative procedures, provided patient education and strategies for self-management, and monitored selected indicators. We summarize the experiences of the two sites in each of these implementation steps and discuss the various approaches and activities they undertook.

Guideline Introduction and Training. Both of the sites began implementing the diabetes guideline with education of providers and clinic staff on the guideline, the DQIP measures, and the accompanying toolkit. Both also noted that they recognized the need for ongoing education and for integrating guideline orientation into education for newcomers.

At one MTF, an orientation session was held with command staff and the chiefs of the family practice and adult primary care clinics. A separate in-service training session was held with the primary care providers on the two clinic teams selected to implement the guideline. At these sessions, participants were presented with data from initial chart reviews, and many were surprised that they were not performing as well on the measures as they had believed. Several areas were identified where additional staff training was needed, including use of equipment (e.g., insulin pumps), taking blood pressure, chart review, ICD-9 coding, and patient education. Concerns were raised about the ability of clinic staff to perform the cumulative functions required by all the practice guidelines.

At the other MTF, a one-hour continuing medical education session was held for providers, including nurses, in January 2000 that was attended by 15 individuals. In this session, the diabetes algorithm was reviewed in detail, and participants identified items they thought should be changed. Clinic staff were introduced to the guideline in a separate session, where implications for tasks they should perform were discussed. Subsequent education focused on specific issues, including coding of diabetes visits and management of newly arrived patients.

Changes in Practices Used to Identify Diabetic Patients. A variety of techniques were tested by the demonstration MTFs to improve the procedures used to manage care for diabetic patients. An early issue to be resolved was how to identify diabetic patients and flag them for the providers. As one MTF team stated, it is not possible to provide adequate diabetes care in a 20-minute appointment if the staff does not know in advance that the patient has diabetes. At one MTF, charts were tagged with a color-coded sticker. In addition, each evening, nurses reviewed the appointment list for the following day to identify diabetes patients and attach the proper forms to the chart. At the other MTF, diabetic patients were assigned to a specific provider, and case management was provided for complex or difficult cases. Both MTFs instituted procedures to prepare patients and prompt providers to perform foot exams.

Patient Education. The two demonstration MTFs took substantially different approaches to patient education, reflecting differences in the size of patient populations served. One MTF had decentralized diabetes patient education that included informal education in the clinics provided by clinic staff along with formal education provided separately by a diabetic educator, a nutritionist, a clinical pharmacist, and a wellness center. The diabetes educator was to see all new diabetes patients, initially for a one-on-one session and then in groups once a week for three weeks. The nutritionist strove to see all patients, but some patients missed or failed to make appointments. Difficult cases were referred to a clinical pharmacist for case management. The wellness center provided education in coping techniques for patients having trouble adjusting to living with diabetes. The patient educa-

tion booklet in the toolkit was used and was reportedly well received by the patients.

The other MTF developed a more centralized patient education approach, in which clinics refer patients for either one-on-one diabetes education or nutrition education. The education emphasized getting the patient involved in self-monitoring. The staff believed the best results were obtained by an initial 45-minute session followed by two or three shorter education visits. The MTF also had a wellness clinic that provided some education for diabetic patients, but this education was not completely coordinated with the in-depth education provided by the diabetes educator. This MTF used its own printed materials for patient education rather than the booklet in the toolkit.

Monitoring and Feedback. Both of the MTFs identified the need for a diabetes registry that would maintain clinical records for each diabetic patient served by the MTF. This resource would support providers in monitoring glycemic control and ensuring that screening for complications and organ system involvement was performed on schedule. One MTF began work on a registry, with limited progress during the time of the demonstration. Delays in development appeared to stem from competing demands for staff time as well as some confusion in the specifications for such a system. The other MTF had planned to develop a registry of diabetic patients in a spreadsheet format but could not do so because of resource constraints and delays caused by data system problems. As of the end of the demonstration, its staff were still working on establishing the data capability to develop this registry and to monitor progress in managing diabetes care.

At the start of the demonstrations, AMEDD did not have the policy framework or information system infrastructure in place to establish an Army-wide diabetes registry, but the topic of registries was addressed at the 1999 toolkit workshop. As a result, MEDCOM initiated efforts to support local registry development that would adapt either the San Diego Naval Hospital system or the Tripler AMC system for use at Madigan AMC. Both systems drew similarly

upon CHCS and ADS data to compile information that providers received as they saw diabetic patients.

With respect to monitoring, one MTF extensively monitored its performance on six of the DQIP indicators, including measurement of indicators at two points in time before start of guideline implementation and one measurement later in the demonstration. Thus, the MTF could track trends in improvements on the DQIP indicators as a result of its service interventions. Data for measurement were obtained monthly from laboratory data and medical chart extraction. Thirty charts were extracted each month, with data entered into a personal digital assistant (PDA). Information was reported routinely to the executive board of directors by the quality management function. Audits currently are reported at the clinical team level, but the staff believes they will not get provider buy-in until data are reported at the provider level.

The other MTF had not yet generated systematic monitoring data as of the end of the demonstration, although a 10 percent draw of medical records for diabetes patients had been performed to check documentation of care. Through this activity, they verified that 80 percent of the diabetes patients were in the internal medicine clinic and that charts for these patients documented care well. The remaining patients were in the family practice clinic. Their charts were generally good, although some were poorly documented. Staff were preparing a second set of chart audits at the time of our second site visit. This MTF was also arranging for data download stations in the clinics and pharmacy, with an ad hoc program being written by the pharmacist to extract the needed data elements.

Highlights of Implementation by the Tricare Senior Prime Demonstration Sites

This section summarizes the implementation process evaluation for the two TRICARE Senior Prime demonstration sites in AMEDD Region 6.

Actions Taken to Implement Practice Improvements

As occurred with the two MTFs in the AMEDD demonstration, the two Region 6 MTFs pursued different strategies to achieve similar results.

One MTF undertook inpatient screening, development and use of a self-report screen tool, use of the automated SF-600 form with preprinted laboratory history and blood pressure, and use of a standard foot exam document and flow sheet. In addition, the MTF did periodic provider education, marketing of diabetes self-care in the community, and patient education. This MTF identified issues that needed further work, including staffing constraints that limited patient access to diabetes management or education programs, foot clinics, and ophthalmology. Additional issues that were documented were missing data for some outcome measures and lack of standardization of tools to document diabetes care in the medical charts.

The other MTF established a comprehensive management process to improve continuity and efficacy of care, and it revised its patient education program to support that process as well as to meet national standards. Issues that this MTF identified for further work included variability in treatment plans and the need to improve drug treatment, patient education, and ancillary treatment. Attention was also given to improving coding accuracy in the diabetes database, achieving more complete chart and laboratory review, contacting patients with missing or high values for diagnostic tests, providing feedback to providers on patients not meeting process goals, and implementing an initiative to improve foot care.

Challenges Stemming from External Factors

The diabetes guideline implementation teams for the Region 6 MTFs identified a number of external factors that substantially hampered their ability to achieve their intended practice improvements:

- Implementation teams were not given resources to support guideline implementation.

- No standard database was available for diabetes patients, and computer capabilities for screening subgroups of patients were limited.
- Coding was problematic because DoD does not enforce system-wide standard codes.
- Education classes by noncredentialed providers are not given manpower credits.
- Patients had limited access to education classes if they were not enrolled in TRICARE.

Lessons Learned: Conclusions and Recommendations Regarding Implementation

MEDCOM Support

- Development and implementation of clinical practice guidelines is a major undertaking that requires a significant commitment of staff resources. The decision by MEDCOM to provide proactive corporate support to the MTFs for their guideline implementation activities was welcomed by the MTFs participating in this demonstration. As more guidelines are introduced, the MTFs may be expected to turn yet more frequently to the MEDCOM staff for support and technical assistance.
- The question of whether and how to use standard documentation forms, which had arisen in the previous demonstrations for the low back pain and asthma practice guidelines, was again an issue for the diabetes guideline. Neither MTF used the standard forms as provided but recognized the need for standardizing documentation of care. A solution is needed that allows effective documentation with provision for management of patients with multiple conditions.
- Effective monitoring of performance in diabetes care, as well as care for other conditions, requires use of consistent coding of diagnoses and procedures in the outpatient encounter records. Although MEDCOM has established standard diabetes codes, use of these codes has been less than complete, at least in part

because DoD does not enforce consistent coding practices. Improvements in coding practices will require repeated education for providers and clinic staff, along with feedback on performance from ADS data.

- The demonstration MTFs duplicated the experiences of MTFs in previous demonstrations with respect to difficulties in extracting and working with the local data needed to monitor performance on the DQIP indicators. Given the current limitations of the military health system's automated data systems, MEDCOM should continue to provide the MTFs with technical support to help them establish the capabilities to monitor progress on the DQIP indicators and report feedback to providers.
- A natural extension of establishing effective data capability for diabetes care is the development of a diabetes registry. Ideally, a centralized registry should be developed that covers all diabetes patients in the system so complete information on diabetes patients can be accessed by MTFs, wherever the patients may be assigned or otherwise located. Lacking that, MEDCOM should provide needed support to the MTFs, including design specifications and programming modules, so they can establish local registries for patients receiving care at their facilities.

Support at the MTF

- The command teams of the participating MTFs provided visible and vigorous support for practice improvements in diabetes care, making it clear that the leadership has placed a priority on achieving the best practices delineated in the practice guideline. This support gave the champions and implementation teams the authority and credibility to carry out their action plans. The teams also were asked to report progress on practice changes and performance on key indicators to the MTF leadership, thus establishing accountability for performance. However, these actions were not accompanied by dedicated financial resources to support the champions and teams in carrying out this work. Participants at both MTFs reported that some practice

improvement actions were delayed or not done at all because of these resource limitations.

- The two demonstration MTFs made very different choices for the guideline champion. The experiences of these champions, as well as those of many others chosen to lead implementation efforts for the low back pain and asthma guidelines, highlight that the champion's specialty is less important than the individual's commitment to the task and credibility with his or her peers. Thus, we reiterate here our findings from previous demonstrations that the champion should be a physician who is motivated to lead the process of changing practices according to the practice guideline, be a respected opinion leader among the providers, and have military rank commensurate to those of his or her peers at the MTF. The champion also should be known to have the authority to make needed changes to procedures and clinical practices.

Differences in the two MTF implementation teams mirror differences across MTF teams found in the earlier demonstrations. The champion and facilitator are clearly the key players in carrying out the guideline action plans, but the composition and role of the rest of the team should reflect the unique service mix and needs of each MTF. Similarly, regular meetings of the implementation team may be useful for some MTFs but less desirable for others. Regardless of meeting format, strategic involvement by team members helps build ownership in the implementation process and support for new practices. An agreed-on mechanism should be established for communications among team members for strategic thinking, troubleshooting issues, and assessment of progress.

CHAPTER FIVE

Effects of Guideline Implementation

In this chapter, we examine the extent to which introduction of the diabetes practice guideline at the demonstration MTFs changed clinical practices at those facilities, as measured by selected indicators. We first examined trends reported by the demonstration MTFs in the DQIP performance indicators they monitored. Using administrative data from the demonstration and control sites, we then analyzed trends in service utilization for the five identified indicators of diabetes care.

Performance Changes Reported by MTFs

As the two AMEDD demonstration sites and two TRICARE Senior Prime demonstration sites introduced new guideline-based clinical practices, they all monitored the effects of changes in their performance using the DQIP indicators described in Chapter Two. Because one of the AMEDD sites and both of the TRICARE Senior Prime sites had been tracking their progress on the DQIP measures before the demonstrations began, they had historical trend information to serve as a baseline.

During the process evaluation site visits, the demonstration MTFs provided information on which indicators they were monitoring (or in some cases preparing to monitor) and how they were performing on those indicators. As shown in Table 5.1, all four

Table 5.1
DQIP and Other Diabetes Indicators Monitored by the Demonstration MTFs

Diabetes Indicator	Demo 1	Demo 2	Demo 3	Demo 4
DQIP—Glycemic control				
Number of HbA_1c Hb_1C-level tests per diabetic patient	Trend	Planned	Trend	Trend
Average levels of HbA_1c for diabetic patients	Trend			
Percentage of patients with HbA_1c greater than 9.5 percent	Trend	Planned	Trend	Not reported
DQIP—Prevent complications				
Percentage of patients assessed for nephropathy	Trend	Planned	Trend	Trend
Percentage of patients with a lipid profile, LDL test annually	Trend	Planned	Trend	Trend
Percentage of patients receiving a dilated eye exam at least annually	Trend	Planned	Baseline	Trend
Percentage of primary care visits at which patients receive a foot exam	Trend	Planned	Planned	Trend
Non-DQIP indicators				
Percentage of patients with controlled blood pressure	Trend	Planned	Planned	Baseline
Percentage of patients with documented diabetes education	Not reported	Planned	Baseline	Baseline

MTFs were collecting the DQIP measures or were planning to do so. Three of the MTFs had tracked the measures over time and had trend data for at least two points in time; one of them had three or more years of data. The fourth MTF had planned to monitor the measures through a patient registry it was developing, but a variety of implementation difficulties slowed progress in establishing its monitoring capability.

In general, the MTFs with trend data reported that their performance had improved on the indicators they tracked from the beginning of guideline implementation.

The sources of data for self-reported the DQIP indicators were either the MTFs' clinical data systems (CHCS) or medical charts. Data on completion of HbA_1c, urinary microalbumin and albumin, and lipid profiles were available in the MTFs' CHCS databases. Data on completion of foot exams had to be obtained from the medical charts. The eye exam indicator data could be obtained from medical

charts or from encounter data for ophthalmology and optometry clinics.

MTF data collection status reports revealed problems with data quality and comparability. The descriptions of what each indicator actually measured were poorly documented (e.g., percentage of patients getting a lipids panel versus percentage with LDL below the specified level). Little documentation was provided for how each measure was calculated, including definitions of the denominators and numerators for the calculations.

Given the current status of the DoD health system data systems (see Chapter Four for discussion), MEDCOM faces substantial challenges to its ability to develop a system for monitoring the DQIP indicators directly at the system level. MEDCOM does not have direct access to the local MTF data, including the MTF CHCS data and medical charts. However, a central repository for pharmacy data has been established in the past few years, and one for laboratory data is under construction. When complete, these databases will be essential resources for tracking many quality performance indicators.[1]

These system-level data limitations prevented RAND from relying on the DQIP measures for the analysis of outcomes, with the exception of the eye exam indicator, for which ophthalmology and optometry clinic-encounter data were available. Thus, as described in Chapter Two, it was necessary to identify a set of appropriate indicators of guideline implementation for which administrative data were available for analysis. The remainder of this chapter reports the results of these analyses.

Analysis of Effects on Service Delivery

For the analysis of trends in service delivery, we compared the care practices of the five demonstration sites before they started working

[1] While not a component of this guideline, a similar capability is needed for radiology data.

with the diabetes practice guideline to their postimplementation practices as well as to the practices of the five control sites.

For each metric, we present a graph of trends in the average values for the demonstration sites and control sites. For the measures of primary care visits, ER visits, and hospitalizations, values are reported for each quarter in the two years of the study. For the measures of use of oral hypoglycemic agents and annual eye examinations, we use annual values reported for each of the two study years. Complete data tables are included in Appendix B. We also tested the significance of observed trends for each metric, using multivariate regression models. The full results of the multivariate modeling also are presented in Appendix B.

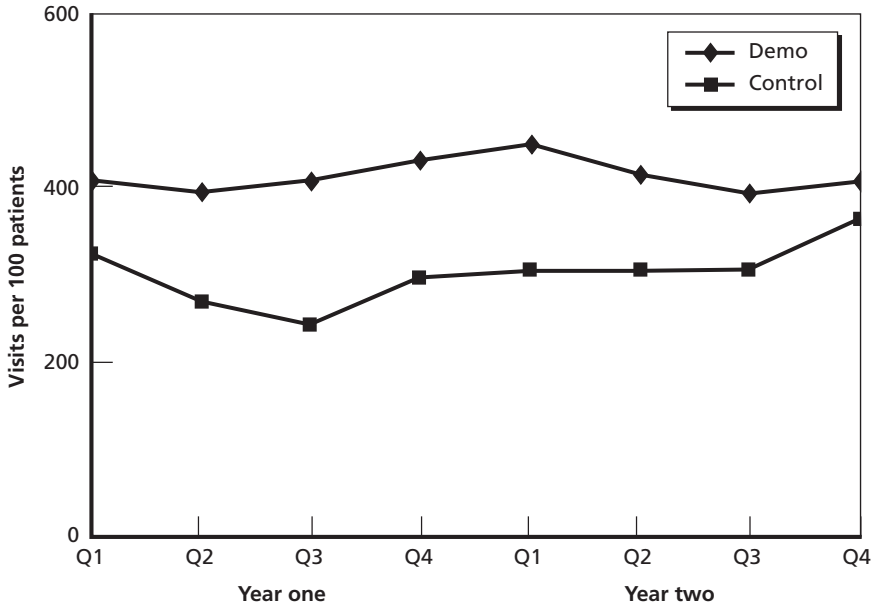
Use of Primary Care Services

We hypothesized that use of the guideline would lead to an increase in primary care visits in the first part of the demonstration, as the clinics introduced new practices to actively manage care for diabetic patients. We also hypothesized that such an increase would be followed by a decline to a lower steady state during the latter part of the demonstration period. To test these hypotheses, we examined trends in the number of primary care visits for all diabetic patients and also separately for patients who used insulin and those who did not.

The baseline primary care visit rates for both insulin-dependent and non–insulin dependent diabetic patients were higher for the demonstration MTFs than for the control MTFs (Figure 5.1). In the last two quarters of the demonstration period, primary care visit rates decreased for the demonstration sites while those for the control sites did not. These differences were statistically significant (see Table B.1 in Appendix B).

No short-term increase in primary care visits was seen early in the demonstration. Such an increase would have suggested that the demonstration sites were bringing in diabetes patients more frequently for care management in response to introduction of the practice guideline. Given that the demonstration sites' primary care visit rates were higher than those for the control MTFs, the demonstration

Figure 5.1
Trends in Primary Care Visits for All Diabetic Patients, by Demonstration and Control Sites



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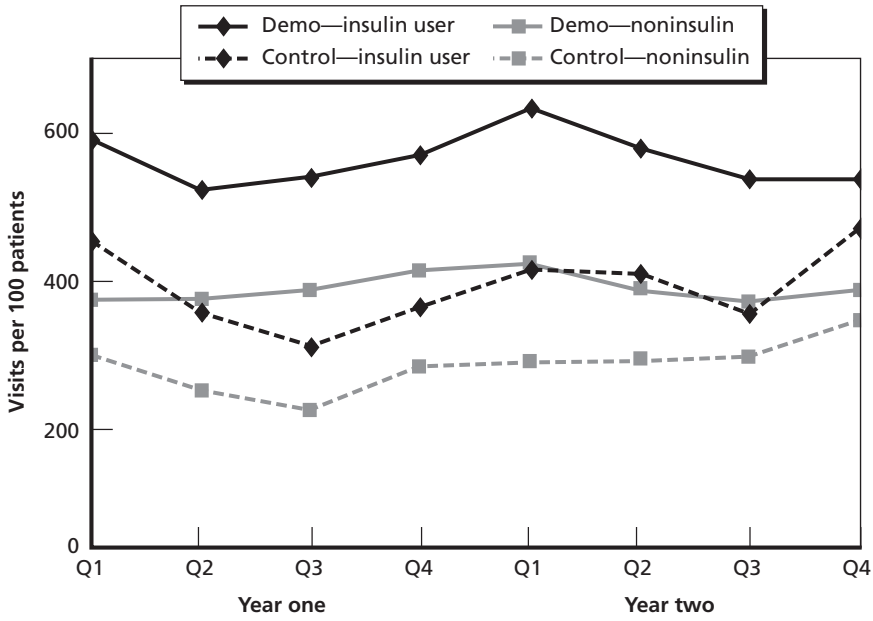
MTFs may already have had appropriate visit rates. However, the data do not show whether the content of those visits changed.

Several reasons could exist for the later decline in primary care use. For example, growing numbers of patients might have undertaken self-care as a result of strengthened patient education (a desirable reason), or the results may reflect a decline in monitoring of the patients by the providers (an undesirable reason). These results are a good example of the need to use clinical and operational information to help interpret findings from administrative data.

The same trends in primary care visit rates were seen for the insulin-dependent and the non–insulin dependent patients (Figure 5.2). However, the noninsulin patients have consistently lower primary care use rates than those using insulin. This result likely

Figure 5.2
Trends in Primary Care Visits for Diabetic Patients, by Insulin User or Nonuser and Demonstration and Control Sites



RAND *MG277-5.2*

reflects the more severe nature of insulin-dependent diabetes and the greater likelihood of the presence of complications or comorbidities, which require greater medical supervision. In addition, a spike in visits for insulin-dependent patients happened in the first quarter of the demonstration period, which did not occur for the non–insulin dependent patients.

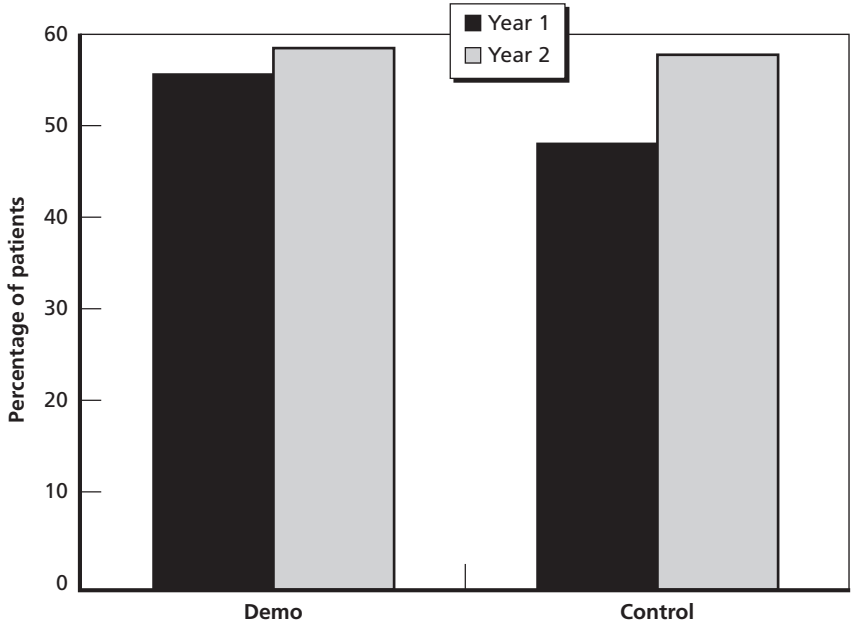
Use of Oral Hypoglycemic Agents to Control Blood Sugar

The diabetes practice guideline places an emphasis on effective glycemic control, which has been shown to reduce diabetic complications. For non–insulin dependent diabetic patients, we hypothesized that the demonstration MTFs whose baseline practices for glycemic control fell short of those specified in the guideline would increase

the use of oral hypoglycemic agents (among other techniques) to control blood sugar.

We measured the use of oral hypoglycemic agents as the percentage of patients who were prescribed one of these medications during a study year (see Figure 5.3). At the demonstration sites, the percentage of patients who filled a prescription for an oral agent rose from 55.6 percent in the baseline year to 58.4 percent in the year following guideline implementation. At the control sites, the proportion of patients who filled prescriptions for oral agents rose from 48.1 percent during the baseline year to 57.8 percent in the year following implementation. Regression results (reported in Tables B.2 and B.3

Figure 5.3
Percentage of Non–Insulin Dependent Diabetic Patients Who Filled Prescriptions for Oral Hypoglycemic Agents, by Demonstration and Control Sites



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in Appendix B) showed that the increase in percentage for the demonstration sites between year one and year two was not significantly different from the increase for the control sites.

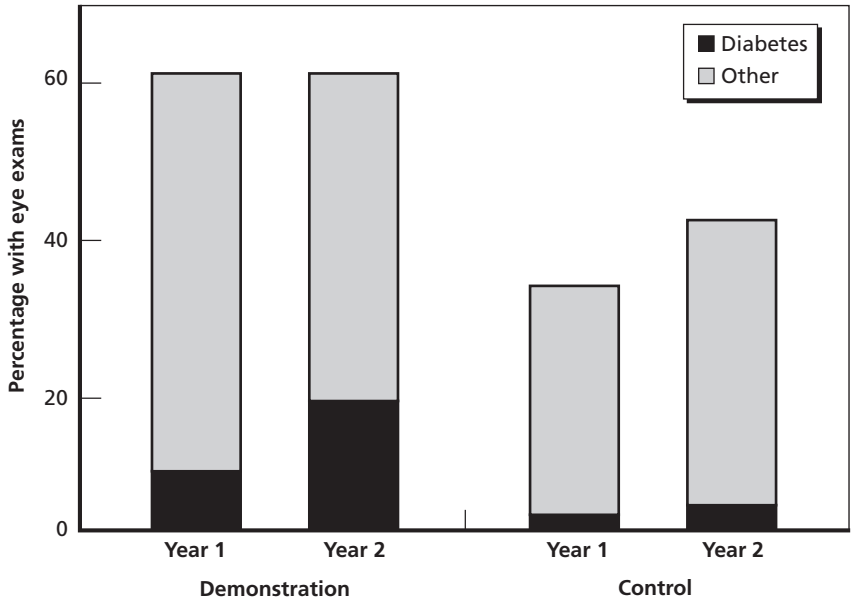
Annual Eye Examinations

The diabetes practice guideline recommends that all patients with moderate to severe diabetes have eye examinations at least annually and more frequently as indicated. The purpose of the eye examinations is to achieve early detection and treatment of any effects of diabetes on the eye to avoid or delay vision loss. We examined the proportion of diabetic patients enrolled at the demonstration MTFs who had at least one annual eye examination. As described in Chapter Two and Appendix A, we defined a patient as having an annual eye exam if the patient had at least one visit to an optometry or ophthalmology clinic, using SADR encounter records with codes for a visit to one of these clinics. We tabulated the total number of patients with at least one visit to an optometry or ophthalmology clinic, as well as the subset of these patients for which diabetes was coded as the primary diagnosis for at least one of their visits, which we defined as having a diabetes-related eye examination.

The proportions of diabetic patients who received an eye examination during baseline were 10.6 percent for patients at the demonstration MTFs and 5.2 percent for control patients (Figure 5.4). By study year two, the proportion of diabetic patients who had eye exams had increased to 19.5 percent at the demonstration MTFs but was only 6.5 percent at the control MTFs.

Although this finding suggests that introduction of the practice guideline contributed to increased use of diabetes-related eye examinations at the demonstration sites, our analysis suggests that the results should be interpreted quite differently. Figure 5.4 shows the percentages of all patients (with or without diabetes as a primary diagnosis) who received an eye examination, as well as the percentage with at least one eye examinations for whom diabetes is coded as the primary diagnosis (reason for the exam). In each of the two study years, slightly more than 60 percent of all patients at the demonstra-

Figure 5.4
Percentage of Diabetic Patients with at Least One Eye Examination Annually, for Demonstration and Control MTFs



RAND *MG277-5.4*

tion MTFs had an eye examination, and the only increase between the two study years was in the percentage of patients for whom the chart indicated the examination was diabetes-related. Therefore, the apparent increase in patients with diabetes-related eye examinations might have been the result of improved coding of the principal diagnosis rather than an increase in the percentage of diabetic patients who had eye exams.

An alternative explanation is also possible for the observed shift in eye exams. If limited staffing and physical space prevented MTF eye clinics from increasing eye exam visits in response to growing demand, an increase in diabetes-related eye visits could have decreased the number of other types of visits offered.

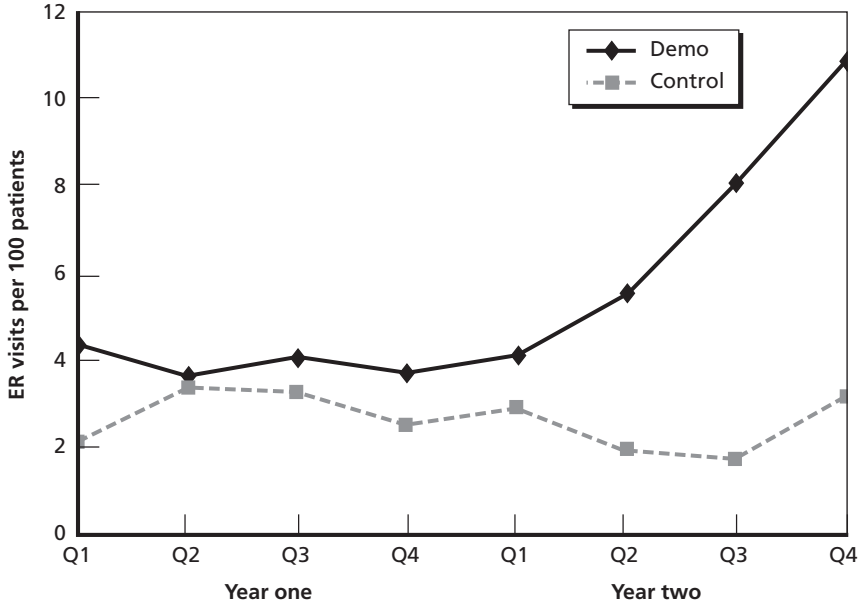
A different pattern is observed for the control MTFs. Although the total percentages of diabetes patients with eye examinations

increased from approximately 35 percent in study year one to 42 percent in study year two, the percentage of patients with diabetes-related eye examinations showed little increase between the two years.

Use of ER Services

We measured ER use as the number of ER visits per 100 diabetic patients per year. Annualized use rates were calculated for each quarter of the two study years to allow trends to be examined. As shown in Figure 5.5, patients at the demonstration sites had higher ER-visit rates than those at the control sites. Examination of trends in use showed a substantial increase from the baseline to the postimplementation period for the demonstration sites, while use rates for the control sites remained stable over the eight quarters of the study.

Figure 5.5
Trends in ER Visits per 100 Diabetic Patients, All Demonstration and Control Sites



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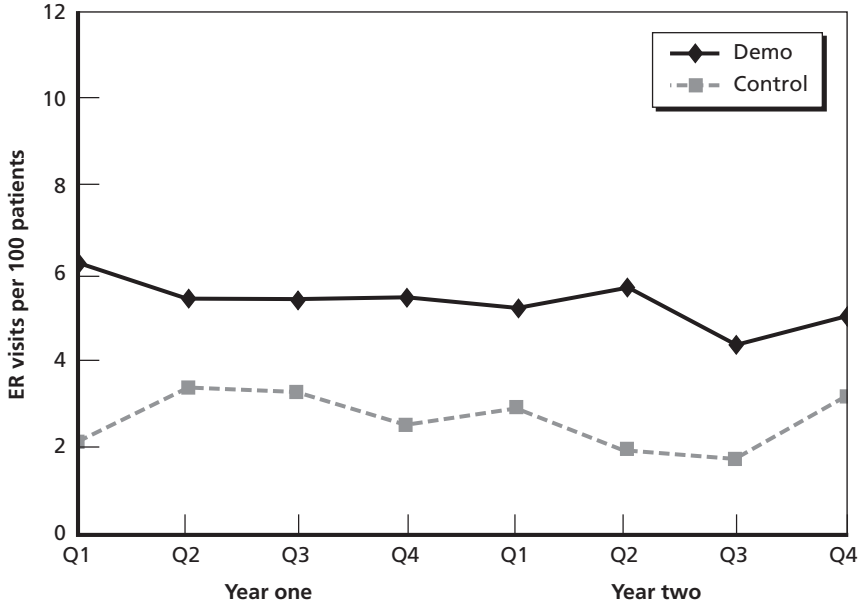
Further examination of rates for the individual MTFs revealed that the apparent increase for the demonstration sites was attributable to increases at one large MTF. We could not determine the reason for this increase, but incomplete data on ER encounters for some quarters could account for at least some of the pattern observed. When data for this MTF were removed from the analysis, the rates for the remaining four sites were found to be stable over time, as shown in Figure 5.6. The regression modeling (Tables B.5 and B.6 in Appendix B) found no statistically significant reduction in ER visits for these four demonstration sites when compared to the control sites.

Use of Hospital Inpatient Services

Two measures were used to assess the effects of introducing the practice guideline on hospitalization: diabetes-related hospitalizations

Figure 5.6
Trends in ER Visits per 100 Diabetic Patients (Demonstration Site 3 Data Omitted), Demonstration and Control Sites



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(hospital stays with diabetes coded as the principal diagnosis) and all hospitalizations (regardless of principal diagnosis). Annualized hospitalization rates, defined as the number of admissions per 100 diabetic patients, were calculated for each quarter of the two study years.

As shown in Figure 5.7, diabetes-related inpatient stays represent 75 to 80 percent of total inpatient stays for the patients in the study sample. The percentages of diabetes-related inpatient stays are similar for the demonstration and control MTFs and did not vary significantly over the course of the study.

Diabetes patients at the demonstration sites had higher total hospitalization rates than those at the control sites, as shown in Figure 5.8. Similar baseline patterns were found for diabetes-related hospitalization rates (see Appendix B). Given the similar trends for

Figure 5.7
Trends in Diabetes-Related or Other Hospital Inpatient Stays per 100 Diabetic Patients, Demonstration and Control Sites

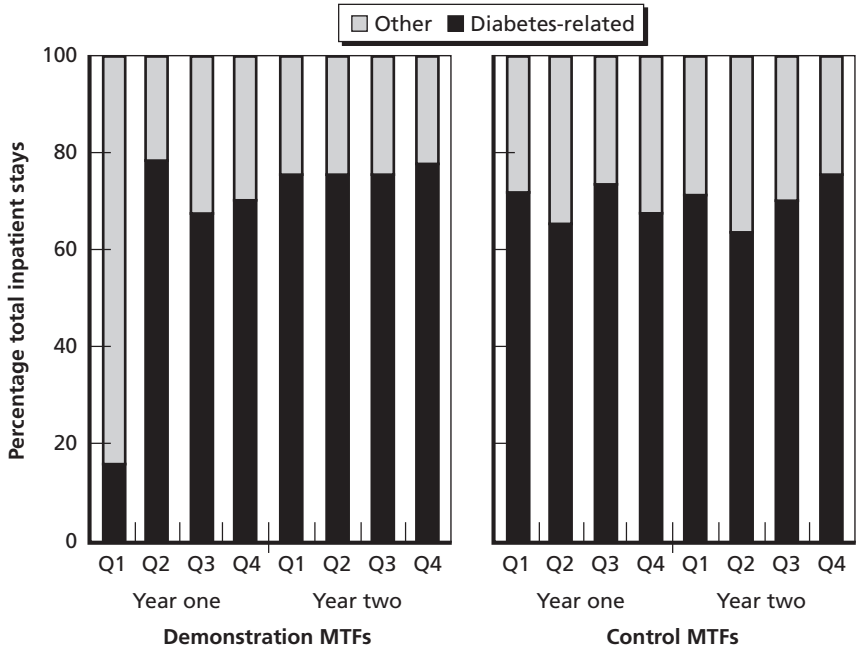

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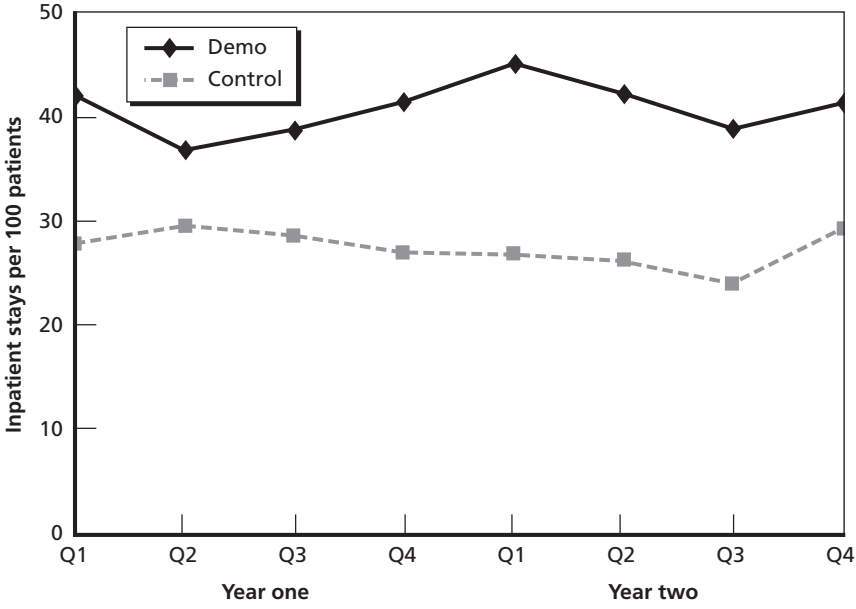
Figure 5.8
Trends in Total Hospital Inpatient Stays per 100 Diabetic Patients, Demonstration and Control Sites



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diabetes-related and total hospitalization rates for the diabetic patients in our sample, we used the total hospitalization rates to analyze the effects of guideline implementation.

Trends in total hospitalization rates were stable for both the demonstration and control sites (Figure 5.8). The regression modeling (see Table B.7 in Appendix B) found no statistically significant change in hospitalization rates for the demonstration sites when compared to the control sites.

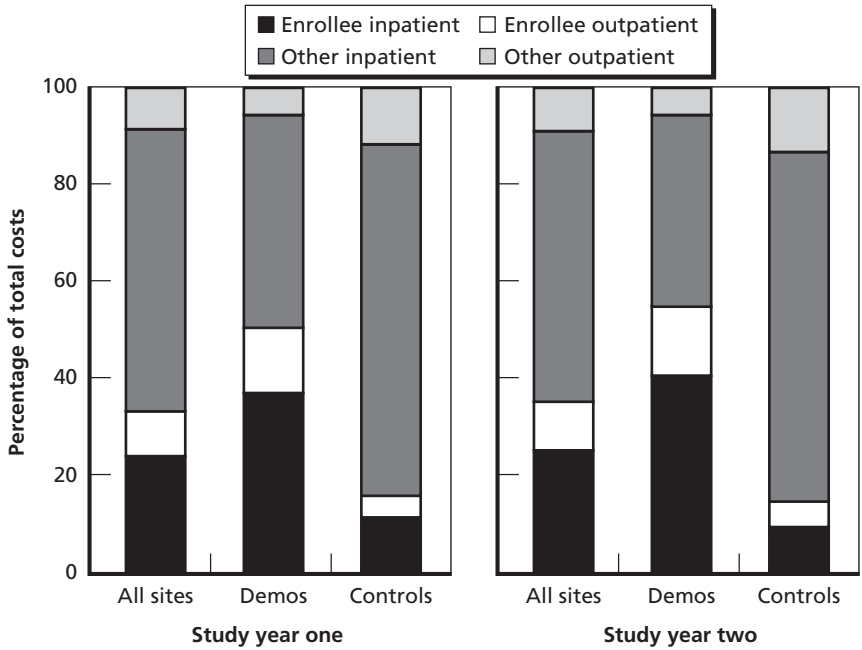
Estimated Costs of Care for MTFs in the Study

We began the cost analysis by looking at the total costs of care for all diabetic patients served by the ten MTFs included in the study. We

looked at costs from two perspectives—the mix of costs experienced by the MTFs for both enrollee and nonenrollee diabetic patients and the mix of MTF costs experienced by each of these two groups of beneficiaries.[2]

A substantial share of the MTF costs for diabetic patients is for nonenrollees, as shown in Figure 5.9. MTF primary care providers have more difficulty managing care for nonenrollees than for enrollees because nonenrollees would use the services of an MTF at which they were not enrolled only on an episodic basis. Comparing the

Figure 5.9
Composition of MTF Total Costs for Enrollee and Nonenrollee Diabetic Patients for Demonstration and Control Sites, by Study Year



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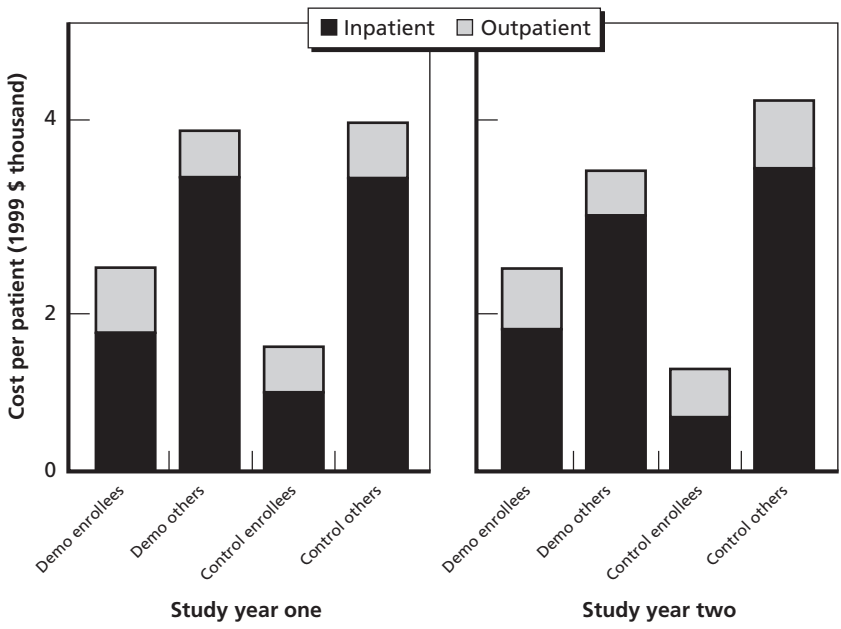
[2] As discussed in Chapter Two, some uncertainty exists about the quality of MEPRS cost data, and the data quality varies across MTFs.

demonstration and control sites, the costs for MTF enrollees were a much larger share of total costs for the demonstration MTFs than for the control sites. This difference was found in both study years.

Figure 5.10 shows estimated average MTF costs from the patient perspective, including total costs and costs for outpatient and inpatient services per diabetic patient. Diabetic patients enrolled at MTFs had lower total MTF costs per patient, on average, than those using the MTFs on a more episodic basis, attributable to the higher MTF inpatient costs for nonenrollees.

Several explanations might contribute to this result. The enrollees may receive more regular care, which would prevent conditions or complications that lead to inpatient stays or reduce the severity of treatment needed during an inpatient stay. For example, enrollees

Figure 5.10
Estimated Total MTF Cost per Patient for MTF Enrollees and Other Users, Demonstration and Control Sites, by Study Year (in 1999 $)



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admitted as inpatients might undergo fewer surgical procedures, which lead to more costly inpatient stays. One might also speculate that enrollees obtain relatively more inpatient care from community providers than the nonenrollees do, but this explanation is not likely because enrollees are expected to obtain care at the MTF where they are enrolled unless the MTF does not offer the services needed.

An alternative explanation for the high nonenrollee inpatient costs can be found in the demographics of the diabetic patients served by MTFs. These patients include a large percentage of individuals over 65 years of age who are eligible for Medicare as well as DoD health benefits. They have access to MTF services only on a space-available basis because Medicare is their primary payer. Under this DoD policy, MTF inpatient care is much more accessible than MTF outpatient services (because the MTFs are underfilled). Further, elderly patients might be more likely to seek MTF inpatient care to avoid the large out-of-pocket costs for civilian hospitals.

An exception to the policy of restricting access to MTF care for elderly beneficiaries was the TRICARE Senior Prime demonstration, in which Medicare-eligible beneficiaries could enroll in an MTF-based managed care plan for three years. This demonstration terminated at the end of 2001. Three of the demonstration MTFs included in the present study were Senior Prime sites at the time of the study. Thus, beneficiaries enrolled in Senior Prime at those MTFs had priority for MTF care equal to that of the TRICARE Prime enrollees, and these beneficiaries were included in our study sample. However, a large fraction of Medicare-eligible beneficiaries at those sites chose not to enroll in Senior Prime, so some elderly enrollees still used MTF care on a space-available basis.

Overall Costs of MTF Services

We also compared average overall costs for diabetes care for study years one and two. Enrollees (our study sample) and nonenrollees who used MTF services were considered separately.

Costs for MTF Enrollees. The aggregate and per-patient MTF costs for diabetic patients enrolled at the MTFs are presented in Table 5.2. The costs incurred by demonstration MTFs for services to

enrolled diabetic patients increased from an estimated $14.9 million in year one to $16.7 million in year two. This is the result of both an increase in the number of patients (from 6,024 to 6,654 patients) and a slight increase in per-patient costs (from $2,477 to $2,514).

These estimates exceed those for the control MTFs, which incurred an estimated $4.6 million in year one and a smaller $4.2 million in year two. The much smaller costs for the control MTFs reflect their smaller number of diabetes patients, less than half the number of those at the demonstration MTFs, as well as substantially lower costs per patient ($1,659 and $1,470 per patient in years one and two, respectively).

For the demonstration MTFs, inpatient services represented approximately two-thirds of the total estimated costs in years one and

Table 5.2
Estimated MTF Costs for Diabetes Patients Enrolled at the Demonstration and Control MTFs, Study Years One and Two

	All Sites	Demonstration Sites	Control Sites
Study year one			
Number of patients	8,779	6,024	2,755
Aggregate costs			
Total	$19,489,575	$14,920,468	$4,569,109
Outpatient	$5,194,683	$3,963,963	$1,230,720
Inpatient	$14,294,892	$10,956,505	$3,338,389
Costs per patient			
Total	2,220	2,477	1,659
Outpatient	592	658	447
Inpatient	1,628	1,819	1,212
Study year two			
Number of patients	9,495	6,654	2,841
Aggregate costs			
Total	$20,905,006	$16,727,238	$4,177,768
Outpatient	$5,922,413	$4,433,434	$1,488,979
Inpatient	$14,982,593	$12,293,804	$2,688,789
Costs per patient			
Total	2,202	2,514	1,470
Outpatient	624	666	524
Inpatient	1,578	1,848	946

NOTE: All costs are in 1999 dollars that were estimated by adjusting 1998 unit cost estimates by an inflation factor of 1.4 percent.

two. By comparison, for the control sites, inpatient services were about three-quarters of total costs for year one, but in year two, the costs shifted such that a relatively larger share was attributable to outpatient services.

The introduction of new care management practices for control of blood sugar and prevention of complications would be expected to increase outpatient care use rates and related costs for the demonstration MTFs. As shown in Table 5.2, the average outpatient cost per patient for diabetic patients enrolled at the demonstration MTFs increased by 1.2 percent from baseline to year two (the difference between $666 and $658). At the same time, however, the average per-patient outpatient cost for enrollees at the control MTFs increased by 17.2 percent. The cost increase for the demonstration MTFs should be assessed relative to the increase for the control MTFs, which represents the temporal trend for costs. Thus, the minor increase in costs at the demonstration MTFs relative to that of the control sites is unexpected.

When we consider these outpatient cost increases together with our earlier findings for primary care visits, the increase in costs appears to reflect increased use of services other than primary care. Because we found no increase in primary care visits for either the demonstration or control MTFs, it appears that patients in both groups of MTFs obtained a larger volume of care from specialty clinics in year two than they did in year one.

This trend should be monitored to assess the mix of services provided and how they relate to practice guideline recommendations. Increased outpatient costs per patient, at least for the first few years after introduction of the guideline, could be consistent with what the guideline defines as effective practices.

The small increase in estimated inpatient care costs for the demonstration MTFs (from $1,819 to $1,848 per patient) suggests that use of the diabetes practice guideline did not yet have an observable effect on inpatient service costs for the MTFs during the first year following guideline introduction. According to our hypothesis, such an effect would have decreased the per-patient cost as more effective care management began to reduce avoidable hospitalizations.

One possible explanation for the absence of cost reduction could be that new practices need to be in use for longer than one year before they achieve observable effects on reducing diabetic complications that lead to hospitalization. Another factor that might be influencing this outcome for the demonstration sites is the growth in number of diabetes patients between the two study years. The additional patients in year two probably represent new enrollees who had obtained care at other MTFs in the previous year, so their health status and service needs would reflect the care management they had at their previous MTF more than the care being provided by the demonstration MTFs.

Costs for Nonenrollees. The costs of care for nonenrollees using the demonstration MTFs are presented in Table 5.3. Total costs for

Table 5.3
Estimated MTF Costs for Nonenrollee Diabetes Patients Using Care at the Demonstration and Control MTFs, Study Years One and Two

	All Sites	Demonstration Sites	Control Sites
Study year one			
Number of patients	9,773	3,768	6,027
Aggregate costs			
Total	$38,748,747	$14,720,636	$24,028,111
Outpatient	$5,374,949	$1,886,865	$3,488,084
Inpatient	$33,373,798	$12,833,771	$20,540,027
Costs per patient			
Total	3,965	3,907	3,987
Outpatient	550	501	579
Inpatient	3,415	3,406	3,408
Study year two			
Number of patients	9,646	3,871	5,810
Aggregate costs			
Total	$38,030,234	$13,526,996	$24,503,237
Outpatient	$5,723,582	$1,800,861	$3,922,721
Inpatient	$32,306,652	$11,726,135	$20,580,516
Costs per patient			
Total	3,942	3,494	4,217
Outpatient	593	465	675
Inpatient	3,349	3,029	3,542

NOTE: All costs are in 1999 dollars that were estimated by adjusting 1998 unit cost estimates by an inflation factor of 1.4 percent.

the demonstration MTFs were an estimated $14.7 million in year one, declining to $13.5 million in year two. At the same time, total costs for the control MTFs increased from $24.0 million to $24.5 million for the two years. Inpatient services accounted for most of the total costs of care for nonenrollees for both the demonstration and control MTFs.

Outpatient care costs for nonenrollees at the demonstration sites decreased from baseline to year two by 7.2 percent (the difference between $501 and $465 per patient), while these costs increased slightly for the control MTFs. This reduction might reflect changes in the way the demonstration MTFs are serving their enrollees versus nonenrollees, or it could simply be a fluctuation in care needs that would not be sustained in following years.

The inpatient costs of care for nonenrollees declined at the demonstration MTFs from baseline to year two by 11.1 percent (the difference between $3,406 and $3,029 per patient), while these costs increased slightly for the control MTFs (Table 5.3). This reduction could also reflect changes in the care the demonstration MTFs are providing their enrollees versus nonenrollees, or it could be a normal annual fluctuation in care needs and related costs.

Variations in Costs Across Facilities

We found substantial variation among the individual MTFs in the costs of care per patient during the baseline year as well as the year following implementation. The total and per-patient outpatient and inpatient costs for enrolled diabetic patients are shown in Tables 5.4 and 5.5, respectively.

Most of the ten MTFs in the study had average annual baseline outpatient care costs of less than $900 per patient (the majority being less than $600). However, costs at two demonstration MTFs exceeded $1,000 per patient (Table 5.4). In year two, the costs for these two MTFs remained high (although one decreased slightly), and the costs for two other MTFs rose to greater than $1,000 per patient. At the same time, per-patient costs declined for four of the other MTFs.

Table 5.4
Estimated Costs of Outpatient Services for Diabetes Patients Enrolled at the Demonstration and Control Sites, Study Years One and Two

	Study Year One			Study Year Two		
Site	Number of Patients	Total Cost	Cost per Patient	Number of Patients	Total Cost	Cost per Patient
Demo 1	2,178	$542,566	$249	2,428	$578,817	$238
Demo 2	111	$119,925	$1,080	128	$123,774	$967
Demo 3	2,149	$2,206,692	$1,027	2,216	$2,243,071	$1,012
Demo 4	680	$360,819	$531	825	$348,036	$422
Demo 5	906	$733,961	$810	1,057	$1,139,736	$1,078
Control 1	1,339	$567,743	$424	1,429	$562,545	$394
Control 2	159	$25,030	$157	96	$22,341	$233
Control 3	351	$305,904	$872	367	$420,361	$1,145
Control 4	489	$157,725	$323	591	$339,591	$575
Control 5	417	$174,318	$418	358	$144,141	$403

NOTE: All costs are in 1999 dollars, which were estimated by adjusting 1998 unit cost estimates by an inflation factor of 1.4 percent.

Table 5.5
Estimated Costs of Inpatient Services for Diabetes Patients Enrolled at the Demonstration and Control Sites, Study Years One and Two

	Study Year One			Study Year Two		
Site	Number of Patients	Total Cost	Cost per Patient	Number of Patients	Total Cost	Cost per Patient
Demo 1	2,178	$5,067,249	$2,327	2,428	$5,607,460	$2,309
Demo 2	111	$53,219	$479	128	$130,230	$1,017
Demo 3	2,149	$4,649,888	$2,164	2,216	$4,612,302	$2,081
Demo 4	680	$563,871	$829	825	$867,628	$1,052
Demo 5	906	$622,277	$687	1,057	$1,076,184	$1,018
Control 1	1,339	$2,093,011	$1,563	1,429	$1,510,587	$1,057
Control 2	159	$6,558	$41	96	$8,731	$91
Control 3	351	$648,698	$1,848	367	$743,063	$2,025
Control 4	489	$229,981	$470	591	$244,126	$413
Control 5	417	$360,141	$864	358	$182,283	$509

NOTE: All costs are in 1999 dollars, which were estimated by adjusting 1998 unit cost estimates by an inflation factor of 1.4 percent.

The individual MTFs also varied in the levels of average inpatient care costs per diabetic patient and the extent to which those costs changed from the baseline to the year after guideline implementation (Table 5.5). The costs for the two demonstration MTFs with

the largest numbers of patients declined in study year two, while those for the three smaller MTFs increased. Almost the reverse pattern was found among the control sites.

Summary

Outpatient visits: The number of outpatient primary care visits per 100 patients was slightly higher for the demonstration sites than for the control sites throughout the study period and did not change for either group.

Use of oral hypoglycemic agents: The proportion of diabetic patients who filled prescriptions for oral hypoglycemic agents increased slightly but not significantly from year one to year two in both demonstration and control sites.

Eye exams: At the start of the study, the proportions of patients who received annual diabetes-related eye exams was low for both the demonstration and control sites, although twice as many demonstration patients received the exams as control patients. At year two, the proportion of demonstration patients receiving diabetes-related eye exams doubled (although the total number of eye exams remained the same) whereas the proportion of control patients remained the same.

Use of ER services: At the start of the study, demonstration patients had greater use of ER services than did control patients. ER use by demonstration patients increased throughout the study period, whereas use rates for control patients did not change.

Use of hospital inpatient services: Diabetes-related inpatient stays, which represented the majority of inpatient service use for the diabetic population, were similar between the demonstration and control sites and did not vary significantly over the course of the study.

Costs of care for diabetic patients: As a proportion of total costs of diabetic care per patient and per MTF, costs of care for nonenrollees was substantial at both demonstration and control hospitals. Nonenrollee inpatient costs far exceeded enrollee inpatient costs. Many of the nonenrollees were over-65 Medicare recipients.

For enrollees, per-patient costs at demonstration hospitals exceeded those of control hospitals for both inpatient and outpatient care and in both study years. From year one to year two, average per-patient costs for both outpatient and inpatient care increased slightly at the demonstration sites, while at the control sites, outpatient costs rose slightly and inpatient costs fell.

For nonenrollees, per-patient costs at demonstration hospitals were comparable to or slightly less than those of control hospitals for both study years. From year one to year two, average per-patient costs for both outpatient and inpatient care fell slightly at demonstration sites, while at the control sites, outpatient and inpatient costs rose slightly.

From one MTF to another, per-patient costs for both outpatient and inpatient services varied widely. It should be noted that based on our analyses, which did not control for other variables that might impact costs of care (such as level of service use, etc), it is not possible to conclude that the observed changes costs noted above can be attributed to the implementation of the diabetes guideline.

CHAPTER SIX

Syntheses of Findings from the Demonstration

As the last of three demonstrations designed to field-test methods for implementing clinical practice guidelines, the diabetes guideline demonstration both confirmed findings from earlier demonstrations and highlighted new issues regarding management practices for diabetes. We observed the success of the participating MTFs in establishing viable implementation strategies and actions, which was a clear improvement on earlier demonstrations, while also observing challenges and barriers shared with the earlier demonstrations. The MTFs participating in this effort were able to draw on lessons from the low back pain and asthma practice guideline demonstrations, as well as their own experiences in implementing other practice guidelines that had been introduced across the system by the time this demonstration began.

In this chapter, we will first discuss the implications of the findings regarding service use and costs. Second, we will provide some observations regarding the factors influencing the successes and limitations of the diabetes guideline demonstration, by examining how well the demonstration performed on the six critical success factors presented in Chapter One of this report. We will also discuss how the implementation activities affected the DQIP measures and other relevant service delivery measures for diabetes patients. Third, we will discuss study limitations. Finally, we will provide some recommendations.

Implications of Findings on Service Use and Cost

The combination of the metrics measured by the demonstration MTFs and our analysis of measures in this study provides useful information for assessing how much progress was made during the demonstration in implementing the diabetes practice guideline. The DQIP indicators represent the most important set of measures of the performance of diabetes care practices. However, given the status of the military health data systems, most of these indicators are best measured locally by the MTFs, and some can only be measured there.

The indicators of service delivery activities that RAND used in this study complement the DQIP measures by examining some of the processes of care that can be measured with administrative data. Observed performance on these indicators can provide information about the underlying processes that might be contributing to performance on DQIP measures.

As we test for effects of guideline implementation, we are guided by the sequence of effects that is likely to occur. The first changes that should be observed are in the processes and procedures used to deliver care, which is where the MTFs were focusing their implementation strategies. As new procedures are institutionalized, which often requires time, changes should be observed in the indicators for clinical care results, such as reductions in avoidable health care events.

MTF Progress on the DQIP Measures. Four of the five MTFs included in our effects analysis reported they were working with the DQIP measures. Three of the MTFs had tracked the measures over time and reported that their performance had improved on the indicators they tracked between baseline and 12 months into the demonstration. Such improvements over time could lead to a reduction in diabetes complications and associated avoidable health-care events (e.g., ER visits or hospitalizations). However, documentation of the DQIP data and comparability across MTFs suggests that these data will be of limited value to MEDCOM for systemwide reporting and MTF comparisons.

Effects Found in the RAND Analysis. The RAND analysis found few effects associated with introduction of the diabetes practice guide-

line. Primary care visit rates for the demonstration MTFs held steady in the first two quarters of the demonstration and then decreased in the last two quarters, compared to the control MTFs. Use of non-insulin glycemic control medications increased from baseline during the demonstration period, as hypothesized, but this increase did not differ significantly from that of the control MTFs.

We found a significant increase in the percentage of patients with diabetes-related annual eye examinations. Further analysis suggested, however, that this increase was the result of improved coding for the diabetes diagnosis on the encounter records, rather than an actual increase in annual eye examinations. Even so, coding improvement is a positive result because accurate coding is essential to effective performance measurement. For ER visit rates and hospitalization rates—indicators that represent potentially avoidable health-care events—we found no change in rates during the demonstration, instead of the declines that would be expected as a result of improved care management.

Given the limitations of the system-level encounter data, the only DQIP measure that RAND could incorporate into its evaluation was the annual eye exam indicator because data could be obtained from ophthalmology and optometry clinic encounters. The other five indicators used in the evaluation were measures of service delivery for diabetic patients. In our analysis of effects on service delivery indicators, we found few effects of the practice guideline for the demonstration MTFs.

DQIP performance data provided by three of the demonstration MTFs suggested improvements in many of the DQIP measures. This improvement contrasts with the virtual absence of improvement in the indicators analyzed by RAND, suggesting that RAND's measures were unable to capture process changes made by the MTFs that resulted in the reported improvements on the DQIP indicators. The likely reason for this discrepancy is that, with the exception of eye exam performance rates (measured as optometry or ophthalmology clinic visits), we counted only total visits and were unable to measure the performance of any types of tests within those visits. Another possibility is that the DQIP performance data provided by the MTFs

may not have been interpreted accurately. Some inconsistencies in definitions and reporting methods suggest the likelihood of this possibility.

Acting on this information from the demonstration, MEDCOM and PASBA initiated Army-wide monitoring of DQIP metrics down to the provider level with aggregation to the clinic, MTF, and MEDCOM levels. MTFs could gain access to data on a monthly basis. MEDCOM encountered a number of definitional and data quality issues with metrics. MEDCOM now has made the transition to DoD-supported guideline metric monitoring.

Variations Across MTFs. When we looked at variations across individual MTFs, we found large differences among the ten MTFs, both in their baseline performance levels and in the extent to which their performance changed from the first to second study years. These variations highlight both major differences in MTFs (that cannot be accounted for without additional information) and the fact that each MTF implemented different practice improvement strategies and priorities, reflecting their unique operational environments, patient mix, personnel and technological resources, and physical plants, none of which could be captured by the indicators used.

Data System Issues. Both feedback from the MTFs regarding data system problems and our experience working with the administrative data in our analyses highlight important barriers that MEDCOM will need to address before it can establish an efficient and effective monitoring system. These issues include lack of integration of individual data systems, poor documentation of systems and procedures, inability to extract data from systems, and difficulties in modifying coding or automated forms.

Three specific data issues created particular challenges for demonstration MTFs.

Inconsistent Coding of Diagnoses and Procedures. Effective monitoring of performance in treating diabetes (and for other conditions) requires consistent coding of diagnoses and procedures in the outpatient encounter records. MEDCOM has established standard codes for diabetes, but these codes have not been used consistently

across MTFs, at least in part because DoD does not enforce consistent coding practices.

During the data analysis, several coding issues were identified that affect the reliability of the data. First, a large percentage of patients were coded inconsistently for diabetes type (i.e., they were coded as Type 1 on some records and Type 2 on others). When the patients who were consistently coded as Type 1 were matched to pharmaceutical data, only a small percentage of these patients had records for insulin prescriptions, suggesting that the pharmaceutical data provided for our study were incomplete. Further, the percentage of inconsistently coded patients who had records for insulin prescriptions was larger than expected, suggesting that this group probably included some Type 1 diabetics.

This finding raises a larger question about the accuracy of the data used to test trends for the indicators in this study, as well as concerns regarding the acceptability of the DoD administrative data for ongoing monitoring of diabetes management practices. The challenge for MEDCOM will be to determine how to handle the coding of diabetes types in administrative data to best provide valid and complete data for ongoing monitoring of care and, ultimately, for a diabetes registry. In addition, issues related to data completeness were highlighted by the clinical laboratory discrepancies.

For any kind of centralized monitoring capability, standardized coding of patient status or procedures is required. The demonstration sites have made progress in defining standardized codes to identify patients, status of condition, and specific procedures. However, these codes have not been used consistently by all sites, with the result that the data aggregated at the system level for these variables may not be consistent and should be used with caution.

Difficulty Extracting Data from MTF Data Systems. The demonstration MTFs faced various challenges in extracting and working with the data needed to monitor performance on the DQIP indicators, ranging from undocumented data files to obtaining space on the local servers. The MTFs are likely to continue to need technical support from MEDCOM to help them establish the needed data capabilities locally. Alternatively, MEDCOM could establish a centralized

system to collect the data directly from automated data systems, perform analyses, and generate trend reports to the MTFs.

Absence of a Diabetes Registry. DoD has no diabetes registry in place, and none of the demonstration MTFs had a centralized registry for diabetic patients in their systems. Thus, it was not possible to obtain complete information on diabetic patients or to track them after they left a particular MTF's care.

Cost Analysis. Our cost analysis provided summary information on total MTF costs for services to diabetic patients, including an assessment of the shares of MTF costs attributable to patients enrolled at the MTFs and to those who used MTF services but were not enrolled. Two key findings emerged. First, we found that a substantial share of MTF costs for diabetic patients during the study years were incurred for patients not enrolled at the MTFs, especially for use of inpatient services. This finding has implications for how best to serve these nonenrollees, considering both issues of care management for episodic users of the facilities and efficient use of outpatient and inpatient resources.

The second key finding from the cost analysis was the small increase in per-patient costs from year one to year two for enrolled patients at the demonstration MTFs, while costs decreased for the control MTFs. This result suggests that early changes in diabetes care practices by the demonstration MTFs may have increased visit rates and costs of care for enrolled patients served by those MTFs. It will be important to track inpatient use rates and costs over time to assess the extent to which early cost increases may reverse themselves and longer term effects begin to be observed after new care management methods are in place for a while. As cost information accumulates for several years, it also will be possible to distinguish trends related to practice changes from normal fluctuations in health-care needs from year to year.

Finally, we note that some criticism was heard within DoD that the MEPRS data overestimate the MTFs' costs of doing business. The source of this criticism is a reported lack of documentation of vacation time, as well as overestimation of the available hours of military personnel time for patient care activities because personnel often

do not record time they spend on military-related activities. While acknowledging this issue, we also understand that MEPRS offers the best available data, and it is the basis for all other cost estimations for the demonstration.

Guideline Implementation: Performance on Critical Success Factors

Research on the practice guideline implementation has documented that a strong commitment to the implementation process, including use of multiple interventions targeted at identified barriers, is required to achieve desired changes to clinical practices. In Chapter One, we outlined six critical success factors that have been found to be essential for success in making lasting changes in clinical and administrative processes. We discuss here the extent to which this demonstration realized these success factors, and we assess implications for progress in implementing practice improvements.

- **Command leadership commitment at the MTF, regional, and corporate levels.** This demonstration provides a positive example of how leadership commitment can support the ability to achieve practice improvements. In this case, the implementation teams had the support of both the MTF commands and the leadership of the TRICARE Region 11 Lead Agent office. The lead agent staff participated in the demonstration as observers, with the intent of implementing this approach in other MTFs in the region.
- **Monitoring of progress.** The performance of the demonstration MTFs in the area of monitoring was mixed. One MTF actively measured trends in performance on the DQIP measures, while another MTF struggled to extract the needed data in the face of inadequate staffing levels and technical problems with its data system. Both of the MTFs performed chart reviews to assess current documentation of care and to extract data on key DQIP measures, with differing success in establishing a routine process

for data extraction. Both MTFs also strove to establish a local diabetes registry, with limited success.

- **Guidance and support to the MTFs by MEDCOM.** By the time the diabetes guideline demonstration began, MEDCOM had well-established staffing and other resources and was providing policy guidance and technical support to help MTFs implement practice improvements for diabetes care. Such support also can encourage movement toward consistency in practices across the Army facilities. We believe this committed support by MEDCOM has been a strong foundation for the practice improvements achieved in the guideline demonstrations, as MEDCOM learned from each field test and applied those lessons to subsequent demonstrations.
- **Guideline champions who are opinion leaders.** The participating MTFs identified well-respected physicians to serve as guideline champions for the diabetes demonstration, and these physicians showed a commitment to leading the implementation activities for their facilities. However, this demonstration (as did the two before it) showed that the champions could make only a time-limited commitment to the initiative, after which they tired of the concentrated effort or had to turn their attention to other priorities. This finding highlights the importance of integrating new practices into ongoing procedures as quickly and effectively as possible.
- **Resource support for champions.** Both of the MTF commanders authorized the champions to lead the implementation of the diabetes guideline, but few of the champions received tangible resource support for their activities (other than attendance at the kickoff conference). In general, they had to perform the implementation work in addition to their regular workload. In both MTFs, a facilitator designated by the MTF commander provided some staff support to the champion, and this role was an integral part of the facilitator's regular job.
- **Institutionalization of new practices.** The participating MTFs made progress in achieving practices consistent with the diabetes guideline, focusing on areas where their performance on DQIP

measures was the weakest. Sustainment of these changes is likely because they addressed clinically important issues, and both providers and clinic staff were involved in implementing the practice changes.

Study Limitations

A number of factors may have contributed to the apparently minor effect of the demonstration. Issues pertaining to data were discussed above. Other factors are discussed briefly here.

- We interacted directly with only two of the five demonstration MTFs and with none of the control MTFs. Therefore, we had little operational information to help explain observed patterns or trends in the indicators for the MTFs in the study sample. Furthermore, we included in the analysis three TRICARE Senior Prime MTFs, which were not fully participating in the evaluation and may have used very different implementation methods.
- The number of actual demonstration sites was small, and those two sites differed greatly with respect to size, location, staffing, and types and numbers of patients served. These sites may not have been truly comparable to the control sites.
- The inability to track individual patients from baseline to year two, coupled with the difficulty in establishing continuity of care when personnel move frequently or when nonenrolled retirees obtain only some of their care at a particular MTF may have decreased the likelihood of our observing real changes.
- A demonstration is an artificial situation. By definition, it is the first field attempt to work with new practices and lacks the full authority of a program officially implemented across an entire system.
- The one-year follow-up time allowed before postimplementation data were collected is too short to expect to find meaningful changes in performance on many of the measures of interest for

quality improvement programs. Alternatively, changes in care processes may have been occurring (e.g., during primary care visits), but the indicators we used could not capture those changes.
- Finally, it is possible that implementation of other care improvement efforts prior to the start of the demonstration, of which we were not aware, may have prevented our observing any measurable improvement.

Recommendations

Although the MTFs participating in the diabetes practice guideline demonstration had some notable successes in some aspects of improving diabetes treatment practices, resource limitations and organizational barriers curbed the overall progress made in the demonstration. Of particular concern was the inability to transfer gains made in the clinics that first worked with the guideline to other clinics within the MTF. Provided here are some additional lessons learned and recommendations.

Implementation

- The MTFs established quite different implementation strategies, which reflected each MTF's unique capabilities and circumstances. We believe this flexibility helps ensure that each MTF can address the clinical practices most in need of improvement. However, this approach puts more responsibility on each MTF for defining its own direction, and it also may slow progress toward the AMEDD goal of achieving consistent practices across its facilities.
- Provision of additional resources to support implementation activities would help the champions and teams achieve lasting improvements in practices.
- To ensure these improvements sustain themselves, regular education sessions will be necessary for providers, clinic staff, and newcomers to the MTF. Regular feedback to providers on per-

formance trends for the DQIP measures will also help to reinforce new practices.

- Each of the guideline demonstrations built on lessons from the ones that preceded it, and, as in the asthma demonstration, the diabetes demonstration continued to yield useful insights. MEDCOM should take actions to strengthen its system in response to the lessons identified in the process evaluation for this demonstration. Indeed, reports from MEDCOM staff confirm that many of the issues identified have been addressed in subsequent activities as several practice guidelines have been implemented across the Army health system.

Benchmarking of MTF Performance

- The assessment of baseline service use for the demonstration and control sites highlights the great variability in practices across the MTFs. MEDCOM and the MTFs should use this baseline information as an integral part of the regular monitoring for effective diabetes care, to identify facilities at greatest variance from established standards and identify factors contributing to the variance. Interventions should be undertaken to correct identified performance problems. This type of benchmarking system not only provides monitoring information to the system and MTFs, but it also can provide an empirical foundation that MEDCOM can used to guide selection of performance priorities and measures for future years.

Outcomes Measurement

- MEDCOM should continue to document variations in performance on key indicators across MTFs on a regular basis to identify areas where improvements in quality and greater consistency are needed. With this information in hand, MEDCOM can determine whether to give the MTFs more specific direction with regard to which aspects of the guideline are to be implemented uniformly.
- It is important to institute a set of indicators that are widely in use across the country, including instructions on how to calcu-

late the measures. Monitoring progress toward best practices was a primary focus of the participating MTFs. Working with the DQIP measures, they created an environment of data-driven implementation and accountability. This approach helped the MTFs focus clearly on the highest-priority aspects of diabetes care, including glycemic control, foot exams, and eye exams.

- Careful measurement of the numerators and denominators for performance indicators will be required to ensure effective monitoring of progress. Several measurement issues arose during the demonstration that hampered effective monitoring—specifically inconsistencies in coding of foot exams, eye exams, and patient education, as well as coding and manpower credit for group visits. The MTFs also had some difficulty in retrieving ADS and CHCS laboratory data.
- The participating MTFs educated both providers and clinic staff on the diabetes practice guideline, and they involved clinic staff actively in the implementation of new practices. This approach seemed to pay off in the willing participation by staff in introducing new practices, including provision of feedback on problems or questions that arose. Further, both MTFs reported they were providing ongoing education for existing personnel, and they were including guideline information in the orientation sessions for incoming staff. Both of these educational activities are needed to sustain improved practices.
- Patient education is an important aspect of diabetes care, especially for the new diabetes patient. Both MTFs had a strong focus on patient education, but they apparently had some problems in effectively coordinating specific aspects of the education, which were performed by different functions within the MTF. Further assistance by MEDCOM might be useful to enhance the ability to reach all patients and offer comprehensive education for managing the various aspects of their diabetes.
- The goal of actions to implement practice improvements is sustainability—the successful integration of new practices into the way MTFs routinely "do business" for patient care. As of the end of the demonstration, the participating MTF teams had not

yet reached the point of fully maintaining the new practices they introduced. They were well positioned to do so, however, if they could put into place effective and routine provider education and performance monitoring processes. The achievement of sustainable practice improvements can be encouraged by MEDCOM through ongoing monitoring and technical support for the implementation activities of the Army MTFs.

- The MTFs reported difficulties in exporting their achievements to other teams and other clinics within the MTF. The amount of work and time required to expand the activities was an important barrier. They found they would have to duplicate on a larger scale the processes they had used for one or two clinics or teams, including leadership by other champions, training of providers and clinic staff, and expansion of patient education activities. To achieve successful introduction and consolidation of new habits among a large number of providers and clinic staff, implementation activities require not only resources but also time to mature.
- For patients with chronic conditions, such as asthma or diabetes, the establishment of a registry would provide a centralized repository of pertinent data that could be shared by all MTFs as the patients move around the military system. Although AMEDD does not have centralized registries, many of the local MTFs are attempting to establish them for their patient populations.
- Two approaches for improving centralized data collection may be considered. MEDCOM could establish a centralized system that collects the data directly from automated data systems, performs analyses in the central office, and generates trend reports to the MTFs. Alternatively, the system could use data collected and analyzed locally by the MTFs and reported to MEDCOM, which then would aggregate the individual MTF results into trend reports. The analyses we performed for this report using solely the administrative data would be a starting point for such a system. Despite the limitations of the information available from administrative data, it remains the most usable data source

because it comprehensively covers a broad range of services. Using the data routinely is one of the best ways to stimulate improvements to coding and data submittals because MTFs want their information to be accurate if it is used for monitoring. If the second approach were chosen, MEDCOM would need to define consistent measurement methods and standards for the MTFs to use, and it would have to perform regular audits for measurement consistency to ensure the integrity of the data for effective performance monitoring. Perhaps the most important information that emerged from the cost analysis was that care for diabetes patients not enrolled at the MTFs represented a substantial share of MTF costs for diabetes patients, especially for inpatient services. This finding raises the question of how the MTFs can best provide effective care management for these nonenrollee patients, given that they are episodic users of the facilities, as reflected in their disproportionate use of inpatient resources.

Costs

With respect to effects of improved diabetes care on MTF costs and return on investment, it is still too early to document any return. It is necessary first to achieve observable changes in resource use and patient outcomes, some of which will require more than one year to emerge. MEDCOM should continue to track inpatient use rates and costs over time. As cost information accumulates, it should be possible to distinguish trends related to practice changes from normal fluctuations in health-care needs from year to year.

APPENDIX A

Evaluation Methodology

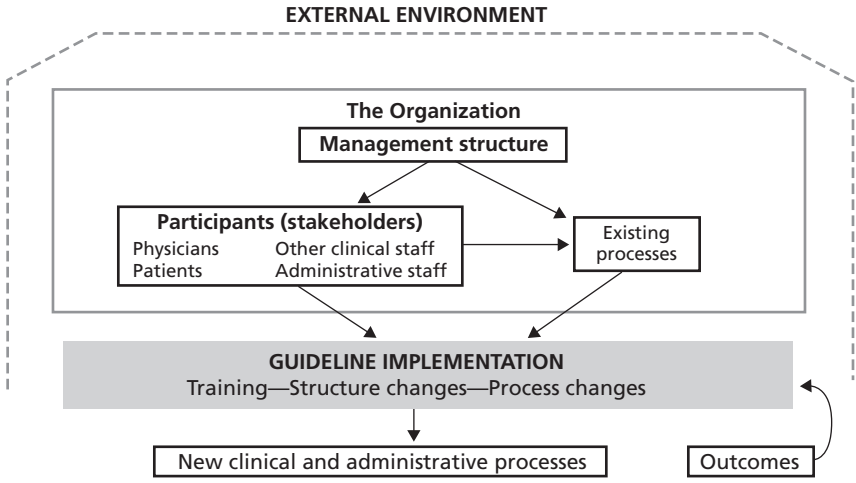
Process Evaluation

To capture the full dynamics of a process as complex as practice guideline implementation, it is important to take into account the roles and interactions of the many aspects of the system in which the guidelines are being implemented. Figure A.1 is a diagram of relationships among the different levels of a health-care organization during guideline implementation, the stakeholders involved, and the dynamics of the implementation process.

A variety of stakeholders need to be considered to ensure that individuals involved in implementing new practices anticipate possible impacts on the stakeholders and responses that might be expected from them. These groups include treatment program leadership, middle management, clinical and administrative staff working with program residents, and clients themselves. The implementation team itself consists of important stakeholders who not only serve as team members but also have other job responsibilities.

Information was collected about the actions involved in practice guideline implementation for participating MTFs, the dynamics of the change process, and responses of participants to their experiences with the process. Similarities and differences in the attitudes, motivations, and preferences of the stakeholders were considered as the process evaluation information was collected and results were synthesized. To capture changes in structures, processes, and issues as

Figure A.1
A System View of Guideline Implementation



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guideline implementation moved forward, site visits were conducted to collect information at the baseline and at two follow-up times, as shown in Table A.1.

A participant-observer approach was used throughout the implementation process and evaluation. In addition to the site visits, we used routine progress reports and maintained an ongoing communication process to provide a structure through which implementing MTFs could get assistance from each other, MEDCOM, or RAND.

Both qualitative and quantitative data collection methods were used in the process evaluation to collect information on a set of questions that cover the dimensions shown in Table A.1. Shown in Table A.2 are the specific topic areas covered and relevant data collection methods. Interviews and focus groups with the implementation team, providers and clinic staff, quality management staff, and other participants yielded information on the dynamics of the implementation process. Focus groups were conducted with three groups: the implementation team, providers, and other clinic staff. Participants in each

Table A.1
Dimensions Addressed by the Process Evaluation

Dimension	Baseline	Month 3	Month 9
Structure and organization	X	X	X
Culture and climate	X		X
Current practices	X	X	X
Environmental context	X	X	X
Stakeholders' attitudes	X	X	X
Implementation plan		X	X
Changes in clinic processes		X	X
AMEDD support systems		X	X
Staff involvement		X	X
Patient roles and reactions		X	X
Monitoring progress		X	X
Effects on stakeholders		X	X

stakeholder group were asked questions regarding their attitudes toward guideline implementation, how they worked with the practice guideline, how they were affected by the implementation process, and issues or concerns they identified. Semistructured interview methods were used for all interviews, group discussions, and focus groups, working from lists of questions to cover during each session.

A brief survey regarding stakeholders' attitudes toward practice guidelines and quality improvement processes was administered at the baseline and the final site visit. The survey at the final site visit also included questions about education received on the guideline, actions taken to implement the new practices, and effects of those actions on providers and clinic staff.

Documents and materials also were important sources of information for the process evaluation. These included written information about the MTF structure and management, policies and procedures, data collection and monitoring, and materials developed by the MTF implementation teams as they prepared and carried out their action plans to change practices. The materials provided the primary documentation on the actions planned by the team, changes made to clinic processes, resulting events, and actions taken to monitor their progress.

Table A.2
Dimensions Addressed by the Process Evaluation Data Collection Methods

	Document Materials	Monitor Reports	Individual Interviews[a]	Focus Groups	Culture Survey
Environmental Context					
How supportive was culture and climate?					X
How did culture and climate change?					X
What were the other factors affecting implementation?			X	X	
The Implementation Plan					
What key guideline elements are priorities?	X	X	X	X	
What information is needed to identify priorities?			X	X	
How is guideline team organized?	X		X	X	
How does guideline team operate?			X	X	
How was guideline introduced to staff?	X	X	X	X	
Planned Changes to Processes					
What process changes did MTFs identify?	X	X	X	X	
Which changes did MTFs implement?		X	X	X	
What factors supported or slowed changes?		X	X	X	
How were implementation plans changed?	X	X	X	X	
AMEDD Systems for Implementation					
What help was received from MEDCOM on implementation?		X	X	X	
How useful was implementation toolkit?		X	X	X	
How useful were KMN, communications		X	X	X	
Did MEDCOM help in the monitoring role?		X	X	X	
Clinical, Administrative Staff Effects					
What were the attitudes of MDs, other staff, at the start?			X	X	X
What were the MD and other staff roles in implementation?			X	X	

Table A.2—continued

	Document Materials	Monitor Reports	Individual Interviews[a]	Focus Groups	Culture Survey
Were the MDs motivated to adopt new practices?			X	X	
What were the effects of changes on MDs and responses?					
What were the effects on other staff workload, demands?					
Roles and Reactions of Patients					
What were patients' responses to changes in care?			X	X	
How did the team manage patient reactions?			X	X	
How helpful were patient education materials?			X	X	
What were the effects on physician-patient relationships?			X	X	
Measuring Implementation Progress					
What were the indicators MTF selected for monitoring?	X	X			
What were the MTF data system for monitoring?	X	X	X	X	
What were the monitoring lessons and actions taken?		X	X	X	
How useful was monitoring to staff?			X	X	

[a]Individual interviews included one-on-one interviews and written questionnaires completed by key participants.

Evaluation of Effects (Outcomes)

The evaluation of the effects of the diabetes practice guideline demonstration was designed to work entirely with administrative data. Ideally, these data would have included a master enrollment file for beneficiaries using the Army MTFs along with files containing data on health service encounters. Unfortunately, although a master TRICARE enrollment file has centralized data on all beneficiaries, these data were not available for use by the AMEDD. Therefore, we

had to work entirely with data from the health service encounters, including SIDR, SADR, and MTF pharmacy data for MTF services and HCSR and NMOP data for network provider services. An extensive process of data extraction, variable derivation, and diagnostic analyses was carried out to

- identify correctly the diabetes population served by the Army MTFs during the two-year study period;
- select the study sample for the analysis of guideline effects on service delivery, consisting of the subset of the diabetes population enrolled at any demonstration or control MTF; and
- establish a database of all health-care encounters for the study sample.

We first document here the specific steps involved in the data extraction process and variable specification to achieve these three work products. Then we summarize the codes used to define the variables for the analysis of demonstration effects.

Overview of the Data Extraction Process for the Diabetes Study

Two rounds of data extraction and file construction were performed in collaboration with PASBA to establish the data required for our analyses. In round one, we extracted data necessary to identify all the diabetic patients served by any Army MTFs or health centers during the two study years, and we established a data file containing a record for each patient along with descriptive data on them that could be obtained from the administrative data. In round two, we extracted data on all encounters for the subset of patients enrolled at one of the MTFs in the demonstration or control groups, which included their use of any military or network provider services for any reason.

We extracted the round-two data in two steps because our initial data request to PASBA occurred soon after the end of the last quarter of the second study year (January 2001–March 2001). Data for this quarter were incomplete for up to six months following the end of the quarter because of delays in processing SADR and SIDR data about MTF encounters, network provider claims that become the

HCSRs, and NMOP claims. Therefore, the initial data pulls covered only the two calendar years of 1999 and 2000. We used these data to perform preliminary analyses that were updated later when data for the final quarter were more complete.

In addition to obtaining data from the SADR, SIDR, HCSR outpatient and inpatient, and NMOP data files, we extracted clinical chemistry data from the database that was constructed through the Triservice Data Pull project in which PASBA participated. This was done only for the patients in the study sample that RAND identified for round two. The data obtained covered the period from June 2000 through June 2001, of which only data for June 2000 through March 2001 were relevant to service delivery during the demonstration period. Baseline laboratory data for the first study year were not available because these data had not been accessed at the DoD level prior to the Triservice Data Pull project. (See Chapter Two for discussion of our diagnostic analysis of these data.)

Round-One Data Extraction Specifications

SADR Data Files

Record extraction rules: Keep all encounter records from the SADR (MTF outpatient) files that meet the following criteria:

- Encounter date between January 1, 1999, and March 31, 2001.
- All individuals eligible for DoD health-care benefits, including active-duty personnel, dependents, or retirees in any service as well as all other eligible groups.
- Have a code in any diagnostic field of 250.xx (diabetes).
- Treated at any Army MTF or clinic (all Army Defense Medical Information System identifications (DMIS IDs), including clinics and TMCs).

The following variables were extracted from the SADR file data:

Alternate care value
Appointment status type
Beneficiary category
Calendar year (created by PASBA)
ID for MTF treating the patient
Disposition code
Diagnosis codes 1 through 4
Encounter date
ID for MTF where enrolled in Prime
Patient Zip code of residence
MEPRS code for clinic of service
MTF location
Patient date of birth
Patient gender
Sponsor Social Security number (SSN)
Family member prefix

SIDR Data Files

Record extraction rules: Keep all encounter records from the SIDR (MTF inpatient) files that meet the following criteria:

- Admission date between January 1, 1999, and March 31, 2001.
- All individuals eligible for DoD health-care benefits, including active-duty personnel, dependents, or retirees in any service as well as all other eligible groups.
- Have a code in any diagnostic field of 250.xx (diabetes).
- Treated at any Army MTF (all Army DMIS IDs, including clinics and TMCs).

The following variables were extracted from the SIDR file data:

Alternate care value
Date of admission
Admission source
Beneficiary category
Calendar year (created by PASBA)
Date of disposition (discharge)
Type of disposition
ID of MTF of service
MTF name
MEPRS code for inpatient unit
Diagnosis codes 1 through 8
Date of disposition (discharge)
Patient Zip code of residence
MTF location
Number of diagnoses
Patient date of birth
Patient gender
Sponsor SSN
Family member prefix

MTF Pharmacy Files

Record extraction rules: Keep all records from the MTF pharmacy files that meet the following criteria:

- Beginning date of service between January 1, 1999, and March 31, 2001.
- All individuals eligible for DoD health-care benefits, including active-duty personnel, dependents, or retirees in any service as well as all other eligible groups.
- At least one prescription from the list of diabetes medications (listed below) using Therapeutic Class Code and National Drug code that was provided by the PEC.
- Filled a prescription at any Army MTF pharmacy (all Army DMIS IDs, including clinics and TMCs).

Outpatient Network Provider (HCSR) Files

Record extraction rules: Keep all encounter records from the HCSR outpatient files that meet the following criteria:

- Beginning date of service between January 1, 1999, and March 31, 2001.
- All individuals eligible for DoD health-care benefits, including active-duty personnel, dependents, or retirees in any service as well as all other eligible groups.
- Have a code in any diagnostic field of 250.xx (diabetes).
- Reside in the catchment area of an Army MTF or clinic. Keep all records coded equal to any of the Army facility parent DMIS IDs, including health centers and MTFs. This will pick up people residing in the parent catchment area even if they used a freestanding clinic with a separate DMIS ID.

The following variables were extracted from the HCSR Outpatient file data:

Beginning date of service
Beneficiary category
Patient catchment area
Calendar year
Defense Enrollment Eligibility Reporting System (DEERS) dependent suffix (DDS)
Diagnoses 1 through 4
Date of birth
End date of service
Enrollment DMIS ID
Enrollment DMIS parent region
Enrollment status
Health service region
Patient age
Patient gender
Patient Zip code of residence
Primary diagnosis
Sponsor SSN
Sponsor service branch

Another variable we did not request was the "type of service" variable, which identifies the specific type of outpatient visit for which the HCSR claim was submitted. This would have been used to identify visits to network provider ERs, which should have been included the indicator for ER use rates. This variable should be included in any future database used for monitoring this indicator.

Inpatient Network Provider (HCSR) Files

Record extraction rules: Keep all encounter records from the HCSR Inpatient files that meet the following criteria:

- Beginning date of service between January 1, 1999, and March 31, 2001.
- All individuals eligible for DoD health-care benefits, including active-duty personnel, dependents, or retirees in any service as well as all other eligible groups.
- Have a code in any diagnostic field of 250.xx (diabetes).
- Reside in the catchment area of an Army MTF or health center. Keep all records coded equal to any of the Army facility parent DMIS IDs, including health centers and MTFs. This will pick up people residing in the parent catchment area even if they used a freestanding clinic with a separate DMIS ID.

The following variables were extracted from the HCSR Inpatient file data:

Admission date
Beginning date of service
Beneficiary category
Patient catchment area
Calendar year
DDS
Discharge status code
Primary diagnosis
Diagnoses 1 through 8
Enrollment DMIS parent region
Date of birth
End date of service
Enrollment DMIS ID
Enrollment status
Patient age
Patient gender
Patient Zip code of residence
Sponsor SSN
Health service region
Sponsor service branch

NMOP Files

Record extraction rules: Keep all records from the NMOP files that meet the following criteria:

- Beginning date of service between January 1, 1999, and March 31, 2001.
- All individuals eligible for DoD health-care benefits, including active-duty personnel, dependents, or retirees in any service as well as all other eligible groups.
- At least one prescription from the list of diabetes medications (listed below) using Therapeutic Class Code and National Drug code that was provided by the PEC. First pull records using Therapeutic Class Code and then pull by National Drug Code from that subset of records.

The following variables were extracted from the NMOP file data:

Alternate care value
Clinic Zip code + 4
Calendar year
DDS
Enrollment DMIS ID
Enrollment parent DMIS ID
Patient date of birth
Patient Zip code of residence
Prescription transaction date (date filled, not date posted)
TRICARE region code
Sponsor service branch

Gender
National drug code
Sponsor SSN
Therapeutic class code

List of Diabetes Medications

Sulfonylureas *(first generation)*
- Chlorpropamide [Diabenese®]
- Tolazamide [Tolinase®]
- Tolbutamide [Orinase®]
- Acetohexamide [Dymelor®]

(second generation)
- Glyburide [Diabeta®, Micronase®]
- Glyburide micronized [Glynase®]
- Glipizide [Glucotrol®]
- Glipizide extended release [Glucotrol XL®]
- Glimerperide [Amaryl®]

Biguanides
- Metformin [Glucophage®]
- Glyburide/metformin [Glucovance®]

Alpha-Glucosidase Inhibitors
- Acarbose [Precose®]
- Miglitol [Glyset®]

Thiazolidinediones
- Rosiglitazone [Avandia®]
- Pioglitazone [ActosTM®]
- Troglitazone or [Rezulin®]

Meglitinides
- Repaglinide [Prandin®]
- Nateglinide [Starlix®]

Insulins
- Insulin (human or beef/pork)
- Insulin lispro [Humalog®]
- Insulin glargine [Lantis®]
- Protamine zinc insulin (PZI)
- Novo Nordisk insulins:
  - Novolin-N for NPH
  - Novolin-R for Regular,
  - Novolin-L for Lente
  - Novolin-U for Ultralente
  - Novolin 70/30 for premixed insulin
- Eli Lilly insulins:
  - Humulin®-N for NPH
  - Humulin®-R for Regular
  - Humulin®-L for Lente
  - Humulin®70/30 for premixed insulin

Glucose test strips
- Precision QID
- One Touch
- Accucheck Advantage
- Chemstrip BG
- Dextrostix
- Diascan
- Glucofilm
- Glucometer Encore, Elite
- First Choice

Round-Two Data Extraction Specifications

Two steps were involved in the final data extraction that was conducted during round two. First, we created the unique identifier for all individual diabetic patients using the round-one data. Then we

extracted data on all encounters for the subset of patients who were always enrolled at one of the demonstration or control MTFs during each of the two study years.

Creation of the RAND ID

A single RAND ID was created for each person that corrected the identifiers for people with incorrect or multiple Family Member Prefix (FMP) relationship variables in the encounter and claims data. This identifier consisted of the sponsor's SSN plus a two-character relationship identifier selected based on the data available to us in the encounter and claims data we used to identify our patient population. For each encounter or claim record, we identified the combination of the sponsor SSN and the date of birth of the individual receiving the service, which were the basis for establishing the RAND identifiers.

The unique RAND ID was established in a two-step process. We first created two files that identified all DDS and FMP codes for each unique SSN/patient birth date combination. The first file contained all of the DDS codes reported in the network provider and NMOP claims files for each SSN/patient birth date combination, as well as counts of the total records with each DDS. The other file contained all of the FMP codes in the SIDR, SADR, and MTF pharmacy records for each SSN/patient birth date combination, as well as counts of the total records with each FMP. Then we combined the information from these two files, generating a single relationship variable for each sponsor SSN/patient birth date in the encounter and claims data.

Combining the information from these two files, a single relationship variable was generated for each sponsor SSN/patient birth date in the encounter and claims data. The RAND ID variable was created by combining the sponsor SSN and the new relationship variable. Precedence was given to the DDS code because this is supposed to be consistent throughout the system, whereas the FMP code is only consistent within the facility:

- if there was only one DDS, the relationship variable was set to that DDS;

- otherwise, the variable was set to the DDS with highest number of occurrences;
- if there was no DDS, the variable was set to the FMP with highest number of occurrences.

This coding process changed the relationship code for an estimated 1.1 percent of the patient population. For less than 0.75 percent of the cases, multiple SSN/birth date combinations received the same relationship variable assignment. Most of these were cases for which the date of birth was entered incorrectly (e.g., month and day switched), which we corrected. Some were real errors in assignments, which were not corrected.

When we created the unique RAND ID variable to identify patients correctly in the database, we appended this variable to each of the encounter or claims data records so that data in the master file could be linked as accurately as possible to service-use data for each patient. Using these data, we created a single summary file that captured most of the relevant information from the Phase 1 encounter and claims data.

Creation of Analysis Master Files

Two summary files containing patient demographics and other characteristics were created using the Phase 1 encounter data. One file contains one record per person per study year; the other file contains one record per person. Summary variables were derived by coding for each variable on individual encounter or claim records and then summarizing them at the person level based on the unique RAND ID codes. For the first step, the following variables were created for each claim record.

Study Year	Study Year of April 1 to March 31, where year = 0 is for 1999–2000 and year = 1 for 2000–2001
Demo-control	Demo = any claim is for service in a demonstration MTF or indicates that the person is enrolled in a demonstration site Control = any claim is for service in a control site or

	indicates that the person is enrolled in a control site Other = no claims for service in either a demonstration or control site Note: For network provider claims, this variable is identified based on the MTF catchment area variable or by a Zip code matched to an Army DMIS ID
Active-duty	Identifies active-duty personnel based on beneficiary category variable
Army	Identifies Army personnel based on beneficiary category variable
Enrollment ID	Identifies whether person enrolled to network, MTF, or not enrolled based on enrollment DMIS ID

Then the variables were summarized by person and study year. Each data source (e.g., SIDR, SADR, PEC) was summarized by person/year and data in these summary files were combined. In addition to the variables described above, place of service and enrollment summary variables are created. Finally, patient demographic variables for age and family relationship were created. The variables were defined using the following coding.

DMIS IDs for MTF location of service	DMIS IDs are the unique identifier codes assigned to each MTF or Army health center. An array of all DMIS IDs for MTFs that were locations of service for the patient's MTF encounters during the study year.
DMIS IDs for TRICARE Prime enrollments	An array of all DMIS IDs for MTFs where the patient was enrolled, as recorded in the patient's MTF encounters during the study year.
User population	Takes one of the following values for location of service for the study year. Based on the location of service DMIS ID for each MTF claim.

	Always Same = all nonmissing DMIS IDs for study year are the same and, for the second year, also are the same as the last DMIS ID for the fourth quarter of the previous year. Same for SY, No Match with Previous SY = all nonmissing DMIS IDs for the study year are the same but not the same as last DMIS ID for the fourth quarter of the previous year. Same for SY, No DMIS Previous SY = all nonmissing DMIS IDs for the study year are the same and no DMIS ID for the fourth quarter of the previous year. Not the Same = nonmissing DMIS IDs are not the same for the study year. No Location Information = any other conditions.
Enrolled population	Takes one of the following values for enrollment information for the study year. Based on the enrollment DMIS ID for each MTF or HCSR claim. Always Same = all nonmissing enrollment DMIS IDs for study year are the same and, for the second year, also are the same as the last DMIS ID for the fourth quarter of the previous year. Same for SY, No Match with Previous SY = all nonmissing enrollment DMIS IDs for the study year are the same but not the same as last the DMIS ID for fourth quarter of the previous study year. Same for SY, No DMIS Previous SY = all nonmissing enrollment DMIS IDs for the study year are the same and no DMIS ID for the fourth quarter of the previous year. Enrolled, Not the Same = nonmissing enrollment DMIS IDs exist for the study year but are not the same. PEC Claims Only for Year = MTF pharmacy records exist but no enrollment DMIS IDs on service-use records for the study year. Never Enrolled in Year = neither any enrollment DMIS IDs on service-use records nor any MTF pharmacy records for the study year.

Type of TRICARE Prime enrollment	Takes one of the following values for type of enrollment for the study year: Enrolled to Demo = enrollment DMIS ID is ever a demo site in study year. Enrolled to Control = enrollment DMIS ID is ever a control site in study year. Enrolled to Network: Demo = enrollment DMIS ID is ever network, patient Zip code in demo catchment area, and place of service DMIS ID is ever a demo site. Enrolled to Network: Control = enrollment DMIS ID is ever network, patient Zip code in control catchment area, and place of service DMIS ID is ever a control site. Enrolled to Network: Other = last enrollment DMIS ID for study year is network in demo or control catchment area and place of service DMIS ID is never a demo or control site. Enrolled to Other MTF = last enrollment DMIS ID for study year is not missing and is not within networks of interest. Never Enrolled in Year = enrollment DMIS ID is missing for entire study year and no MTF pharmacy claims PEC Claims Only for Year = MTF pharmacy records exist but no enrollment DMIS IDs on service-use records for the study year.
Analysis population	Indicates whether person is in the analysis population for the study year. Based on enrolled population (enrpop) 1 = If "enrolled population" variable is "Always Same" or "Same for SY, No DMIS prev SY" and the first enrollment DMIS ID is a demonstration site 2 = if "enrolled population" variable is "Always the Same" or "Same for SY, No DMIS prev SY" and the first enrollment DMIS ID is a control site. 0 = Otherwise.

Age for study year	Age at December 31, calculated from date of birth and study year
Five-year age categories	Four-level age category variable for study year: Less than 18 years, 18–44 years, 45–64 years, or 65+ years
Relationship category	Classified as child, spouse, parent, or other

Creation of Identifier Files for Data Extraction from DDS and FMP Files

For the round-two data extraction process, two files were sent to PASBA that contained lists of unique patient identifiers for all the diabetic patients we identified as being in our study sample for the analysis of guideline effects. We requested an extraction of all encounter records for these individuals for all MTF services, network provider services, and pharmacy prescriptions. One file was to be used to extract all claims for each patient identifier from files that use the DDS relationship variable (outpatient and inpatient network provider files, NMOP files), and the other was to be used to extract claims from files that use the FMP identifier (SIDR, SADR, PEC pharmacy data).

To create the identifier files, an index file was constructed that contained all unique sponsor SSN/FMP and sponsor SSN/DDS combinations for all patients identified as always enrolled at one of the demonstration or control sites. All identifiers reported in all the MTF encounter records and network provider HCSRs were captured. Patient identifier records then were output to each of the two identifier files, using the following rules:

A. Identifier file for extraction of data from files using the DDS relationship variable (network provider NCSRs, NMOP)—

1. If the relationship variable is based on a DDS, then output the record with sponsor SSN and DDS.

2. If the relationship variable is based on FMP:
   a. If the person is a child (FMP 1–19) then do the following
      1) If FMP is 1–4 then output one record for each FMP 1–4 (four records)
      2) If FMP is 5–19 then output record with this FMP as well as one record for each FMP 1-4 (five records)
   b. If the person is a spouse (FMP 30–39):
      1) If FMP is 30 or 31 then output one record for both FMP 30 and 31 (two records)
      2) If FMP is 32–39 then output record with this FMP as well as one record for each FMP 30 and 31 (three records).
   c. If the person has any other code, output one record.

B. For identifier files for extraction of data from files using the FMP relationship variable (SIDR, SADR, MTF pharmacy), only the FMP variable is used because there is no DDS identifier in the encounter records—

   a. If the person is a child (FMP 1–19) then do the following:
      1) If FMP is 1–4 then output one record for each FMP 1–4 (four records)
      2) If FMP is 5–19 then output record with this FMP as well as one record for each FMP 1–4 (five records).
   b. If the person is a spouse (FMP 30-39) then do the following:
      1) If FMP is 30 or 31 then output one record for both FMP 30 and 31 (two records)
      2) If FMP is 32–39 then output record with this FMP as well as one record for each FMP 30 and 31 (three records)
   c. If the person has any other code, output one record.

Definition of Key Outcome Variables

Indicators selected for the evaluation of guideline effects were those that could be measured using available administrative data on health-care encounters, use of prescription medications, and the demographic and clinical characteristics of the clients. The data used to derive these variables were in the master file on the diabetic patients

in the study sample, along with the comprehensive encounter data obtained in the round-two data extraction. For each outcome variable, we subset the records for the study sample from the master file and then used the unique RAND ID codes to merge the patient data to the round-two encounter or claims data required to derive the variable. When we obtained the round-two data from PASBA, we appended the RAND ID codes to each encounter or claim record in the data using the sponsor SSN/patient birth date combination as the linking variable.

We were able to obtain the data for all encounters from the round-two data extraction except the network provider outpatient services. The DoD files containing these records were extremely large because they contained records for all TRICARE beneficiaries. Because of the limitations of the data system that PASBA used to extract the data, they could not use standard data management methods to merge the index file of patient identifiers to the identifiers on the claims data. They attempted to perform the data abstraction on subsets of the DoD data by month, but the resulting data files were inconsistent in format and content and we could not use them.

The specific data elements or codes used the define these variables are listed below:

Indicator of Guideline Effect	Codes Used for the Definition
Number of primary care visits per diabetic patient: All patients	Primary care visit was defined as a visit to an MTF internal medicine (BAA), family practice (BGA), pediatric (BDA), adolescent (BDB), primary care (BHA), or flight medicine (BJA) clinics (MEPRS codes).
Patients on insulin Non–insulin users	Patient on insulin was defined as one with at least two insulin prescriptions, including Humalog, Humulin, Iletins, Isophane, Insulatard, Lantis, Mixtard, Novolin, Relion, human insulin, beef insulin, pork insulin, Protamine zinc, or Velosulin. All others were coded as non–insulin users.
Percentage of non–insulin dependent diabetic patients using medications to control hyperglycemia	Patient use of oral hypoglycemic agents was defined as having at least one prescription filled for one of the sulfonylureas, biquanides, thiazolidinediones, or meglitinides.

Percentage of diabetic patients who had at least one eye exam annually	Eye exam was defined as a visit to an MTF optometry clinic (BHC) or ophthalmology clinic (BBD) (MEPRS codes).
Number of ER visits per diabetic patient	MTF ER visit was identified using MEPRS code BI (network provider ER use data were not available for this study, but also should be included).
Number of hospitalizations per diabetic patient	Each SIDR or network provider inpatient encounter was identified as a hospitalization.

Cost Estimation Methodology

Estimation of MTF Unit Costs

To estimate the costs of care for diabetic patients at the Army MTFs included in this study, MEPRS financial data were used to develop sets of unit costs for inpatient and outpatient encounters. The relevant estimated unit cost then was applied to each unit of service included in the SIDR and SADR encounter records. We note there has been some criticism within the DoD that the MEPRS data overestimates the MTFs' costs of doing business. The source of this criticism is a reported over-estimation of the available hours of military personnel time for patient care activities because personnel often do not record time that they spend on military-related activities. While acknowledging this issue, we also understand that MEPRS offers the best available data, and it is the basis for all other cost estimations for the demonstration.

The cost estimation methodology we developed mirrors its approach the PLCA method developed by SRA for the Medicare-DoD Subvention Demonstration. For this cost analysis, we used cost and workload data that SRA generated for MTF outpatient clinics or inpatient wards for all MTFs in the DoD system for FY 1998. The estimated unit costs included total direct and indirect expenses for each MTF cost center (ward or clinic), including direct expenses for staff time and supplies as well as indirect expenses for ancillary clinical services, administrative services, and maintenance and other support

services. We summarize here the methodology for calculating the inpatient and outpatient costs.

We updated the unit costs to FY 1999 estimates by applying an inflation factor of 1.4 percent. These same unit costs were applied to encounters for both study years. By holding costs constant over time, any observed changes in costs between study years one and two can be attributed to changes in utilization.

We tested two references for Medicare cost increases to determine the 1.4 percent inflation rate. The first was the trend in the U.S. per-capita costs (USPCC) for fee-for-service beneficiaries that the HCFA Office of the Actuary calculates each year. For the years 1996 through 1999, the USPCC increased at an annual rate of 1.4 percent. We also used the annual rate of increase in the M+C county-level capitation rates, which the Balanced Budget Act of 1997 mandated are to be equal to the rate of increase in Medicare fee-for-service costs. The annual updates used by HCFA to establish the capitation rates for calendar years 1999 and 2000 were 1.88 percent and 0.90 percent increases, respectively, over the previous year. These also average to 1.4 percent. Because DoD payment policies mirror Medicare policies, payments discounted using this inflation rate represent increases in what either DoD or Medicare would have paid community providers if the service had been provided in FY 1998 instead of FY 1999.

Inpatient Stays

We estimated the cost per inpatient stay for each MTF inpatient stay using the following formula:

$$\begin{aligned}\text{Cost for inpatient stay } i \text{ in ward } j = \\ (\text{medical per diem cost})_{ij} \times (\text{number of days})_{ij} + \\ (\text{surgical per diem cost})_{ij} \times (\text{number of days})_{ij} + \\ \text{surgical cost for surgical DRG},\end{aligned}$$

where the number of bed days for each type of inpatient ward—medical or surgical—is the sum of the ward and intensive-care unit (ICU) days in the SIDR. DRG is the Diagnosis-Related Group

assigned to each inpatient stay based on the patient's principal diagnosis and treatment. Medicare uses DRGs as the basis for payments for inpatient services, and DoD uses DRGs to establish amounts billed to third-party insurers for MTF inpatient services.

For each inpatient ward in an MTF identified by the MEPRS level-3 accounts (the level that inpatient wards are coded in the SIDR), we obtained the following MEPRS data that we used to calculate average total per-diem expenses:

a. Total expenses including all stepped-down expenses from MEPRS accounts D and E *except for* surgical expenses (anesthesia, surgery suite, and recovery-room expenses).[1] These costs included clinical salaries, direct operating costs, support costs, allocated ICU and ancillary service costs, allocated costs from purification of cost pools that contain costs related to more than one account, and resource-sharing costs that SRA assigned to the inpatient ward.
b. Total number of occupied bed days (OBD) during the year, which will be used with total expenses to generate an estimated total expense per OBD.
c. For each surgical DRG, we obtained an estimated average MTF-level surgical expense that included expenses for anesthesia, surgery suite, and recovery room. This cost estimate was derived as the total MTF surgical expenses divided by the total weights of surgical DRGs during the year, where surgical costs were estimated using the same method that SRA applied for the PLCA calculations. For each surgical disposition, we multiplied the MTF average surgical cost by the DRG weight for the DRG assigned to the patient stay.

This approach allowed us to capture all expenses for an inpatient stay using a consistent methodology across all the years of inpatient

[1] The MEPRS D accounts are clinical ancillary services (e.g., pharmacy, pathology, intensive care), and the E accounts are support services (e.g., administration, housekeeping, laundry, depreciation).

records included in our analysis. This method smoothes out errors in reporting movement of patients between ICUs and regular inpatient wards by estimating average per-diem costs that include costs for the regular ward services plus related ICU services. At the same time, it captures the onetime costs associated with the surgical procedure performed for each surgical stay by applying these costs separately for each event. The method also allows costs to increase with length of stay, thereby capturing some of the additional costs incurred by the older population. However, this approach assumes that ancillary costs are a linear function of days, whereas it is known that these costs tend to be concentrated in the early days of an inpatient stay (Carter and Melnick, 1990). Therefore, the method sacrifices some precision in estimating ancillary service costs, although SRA has informed us that total MTF ancillary costs correlate strongly with length of stay.

Outpatient Visits

For each clinic in an MTF identified by the MEPRS level-four accounts (the level that clinics are coded in the SADR), we obtained the following MEPRS data that we used to calculate average total expenses per outpatient visit:

a. Total MEPRS level-four expenses for the clinic for each year, including the resource-sharing expenses that SRA has estimated and assigned to each clinic.
b. The MEPRS count of total outpatient visits in the clinic during the year.
c. Within the total expenses, separate identification of the expenses for laboratory, radiology, pharmacy, all other ancillary services (including allocated costs from purification of cost pools), and resource sharing.

These data allowed us to calculate the average total cost per visit for each clinic in an MTF and to estimate the shares of the total clinic expenses that are attributable to ancillary services.

APPENDIX B

Analyses of Diabetes Metrics

To test for effects of the introduction of the DoD/VA diabetes guideline on service utilization and prescription patterns, we fit a series of regression models to predict effects on each of the six measures for diabetes treatment. We present in this appendix tables with descriptive statistics for each measure, as well as results of the regression models that tested for possible effects of guideline implementation on trends for each measure.

As described in Chapter Two, the study sample for this analysis consisted of all members of the larger study sample who were enrolled for the entire year at one of the demonstration MTFs or control MTFs. Separate samples of enrollees were defined for each of study years one and two based on enrollments reported in the encounter data for each year.

The unit of analysis for all of the measures was the patient, so there was one data record for each patient with variables for each of the measures. The variables for primary care visits, ER visits, and hospitalizations were continuous variables of the counts of relevant events. The variables for eye examination and use on oral hypoglycemic agents were dichotomous variables that indicated the presence or absence of each event.

We used ordered logistic regression models to test the size and statistical significance of effects for primary care visits and hospitalizations because these events were frequent enough to yield a distribution of patients by number of visits or inpatient stays. We coded a three-level variable for primary care visits (0, 1, 2, 3+ visits) and a two-level variable for hospitalizations (0, 1, or 2+ stays). Because ER

visits were more rare events, we coded a dichotomous variable for each patient for having at least one ER visit or not. We used standard logistic regression models to test effects on ER visits as well as effects on eye examinations and use of oral hypoglycemic agents.

The predictor variables in the models included dummy variables for each quarter with quarter four omitted as the referent variable (the last quarter before the demonstration started), a dummy variable for demonstration site, and variables to control for patient characteristics. We controlled for the patient characteristics of insulin user, gender, and age categories. The referent age category in our models was 46–64 years and the other categories were birth to 17 years, 18 to 45 years, and 65 years or older.

Guideline effects were measured using interaction terms of demonstration site by each of the four-quarter dummy variables for the demonstration period (the fifth through eighth quarters). The coefficient on each quarter variable estimated the difference in a measure between demonstration and control sites relative to the baseline period—i.e., the effects of the demonstration.

In logistic regression models, the magnitude of effect for a unit change in a variable can expressed as an odds ratio, which is obtained by exponentiating the variable's coefficient. An odds ratio is defined as the odds that an outcome variable will occur divided by the odds that it will not occur. An odds ratio for a predictor variable that is equal to one (equal odds) indicates that the variable has no effect on the occurrence of the outcome. An odds ratio greater than one indicates that the variable increases the probability of the outcome occurring, and an odds ratio of less than one indicates that it decreases the probability. We report here both the statistical significance of the predictor variable coefficients and the odds ratios for the models estimated for the six diabetes metrics.

Primary Care Visits

The rates of primary care visits by group and individual MTF are reported for all diabetic patients in Table B.1 and for noninsulin patients in Table B.2. Results of the logistic regression analysis for

Table B.1
Average Annualized Primary Care Visit Rates per 100 Patients for All Diabetic Patients, by MTF and Quarter

	Study Year One Quarters				Study Year Two Quarters			
Facilities	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Demonstration Sites	408	396	408	432	452	412	392	404
Demo 1	316	288	284	336	352	336	308	328
Demo 2	604	604	432	528	436	352	624	544
Demo 3	456	476	444	464	452	440	412	404
Demo 4	384	380	480	428	428	344	236	284
Demo 5	492	444	560	588	692	600	636	668
Control Sites	320	268	240	296	304	304	304	360
Control 1	352	336	320	332	324	320	296	320
Control 2	128	184	248	204	396	372	280	460
Control 3	276	196	272	364	304	196	284	416
Control 4	360	156	20	212	232	344	372	456
Control 5	288	280	208	260	300	252	244	292

NOTE: Annualized primary care visit rates are calculated as four times the number of visits in a quarter divided by the number of patients in the relevant study year and applying 100 as an adjustment factor to standardize to a rate per 100 patients.

Table B.2
Average Annualized Primary Care Visit Rates per 100 Patients for Non–Insulin User Diabetic Patients, by MTF and Quarter

	Study Year One Quarters				Study Year Two Quarters			
Facilities	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Demonstration Sites	380	376	388	412	424	388	372	388
Demo 1	260	256	252	300	308	296	284	304
Demo 2	572	584	392	472	444	344	568	500
Demo 3	440	460	432	452	436	428	392	396
Demo 4	360	368	444	412	412	332	232	268
Demo 5	468	412	532	560	652	560	612	636
Control Sites	304	256	228	288	288	292	300	348
Control 1	340	324	312	328	312	312	292	316
Control 2	120	180	228	184	364	360	280	460
Control 3	244	168	256	356	288	168	268	348
Control 4	360	148	16	208	216	332	372	444
Control 5	248	264	188	240	292	240	232	288

NOTE: Annualized primary care visit rates are calculated as four times the number of visits in a quarter divided by the number of patients in the relevant study year and applying 100 as an adjustment factor to standardize to a rate per 100 patients.

trends in primary care visits for all diabetic patients in our sample are reported in Table B.2.

The lower primary care visit rates for the demonstration sites in the last two quarters of the demonstration period are statistically significant and are shown in the coefficients and odds ratios for the demo * quarter interaction terms in the model (see Table B.3). The significant odds ratios of 0.87 and 0.83 for the interaction terms indicate that patients in the demonstration sites were less likely to use primary care visits in the last two quarters. The nonsignificant odds ratios for the main effect variables for quarter seven and quarter eight represent the trend for the control sites.

Table B.3
Ordered Logistic Regression Model of Estimated Guideline Effects on Number of Primary Care Visits per Diabetic Patient

Parameter	Estimated Coefficient	Standard Error	Odds Ratio
Demonstration (1,0)	0.31***	0.02	1.36
Quarter 1	–0.01	0.03	1.00
Quarter 2	–0.10**	0.03	0.91
Quarter 3	–0.11**	0.03	0.89
Quarter 5	0.02	0.05	1.02
Quarter 6	–0.01	0.05	0.99
Quarter 7	0.03	0.05	1.03
Quarter 8	0.12**	0.05	1.13
Male	0.01	0.01	1.01
Age birth to 17 years	–0.01	0.05	1.00
Age 18 to 45 years	–0.42***	0.02	0.66
Age 65+ years	–0.06**	0.02	0.94
Insulin user	0.52***	0.02	1.68
Interaction terms			
Demo * quarter 5	0.01	0.05	1.01
Demo * quarter 6	–0.03	0.05	0.97
Demo * quarter 7	–0.14**	0.05	0.87
Demo * quarter 8	–0.19**	0.05	0.83
Intercept 1	–2.24***	0.03	
Intercept 2	–1.25***	0.03	
Intercept 3	0.18	0.03	

** $p < 0.01$, *** $p < 0.001$.
NOTE: The omitted group for the model is quarter four, which is the baseline period that immediately preceded the start of implementation activities by the demonstration MTFs.

Also of interest, use of insulin and age were significant predictors of use of primary care visits, but gender was not. Insulin users were more likely to use primary care services. Patients in referent age group of 46 to 64 years were the heaviest users of primary care services. Compared to this group, younger patients used much less primary care, and older patients used slightly less care. Similar results were obtained for regressions modeled separately for insulin users and nonusers (not presented here).

Use of Oral Hypoglycemic Agents to Control Diabetes

The percentages of noninsulin patients prescribed other medications to control diabetes, by group and individual MTF, are reported in Table B.4. The results of the logistic regression analysis for this measure are reported in Table B.5.

For this analysis, we estimated the number of these patients for each of the two study years, and the regression analysis compared the percentage of patients who used other medications before and during the demonstration period. The combined coefficients and odds ratios

Table B.4
Percentage of Non–Insulin Dependent Diabetic Patients Prescribed Oral Hypoglycemic Agents, by Demonstration and Control Sites and Year

	Percentage of Noninsulin Patients on Medications	
Facilities	**Study Year One**	**Study Year Two**
Demonstration Sites	55.6	58.4
Demo 1	56.8	60.1
Demo 2	58.5	63.1
Demo 3	57.9	61.2
Demo 4	49.5	49.2
Demo 5	51.5	55.5
Control Sites	48.1	57.8
Control 1	55.1	61.2
Control 2	12.7	31.3
Control 3	44.1	49.7
Control 4	46.3	59.9
Control 5	45.7	55.7

Table B.5
Logistic Regression Model of Estimated Guideline Effects on Number of Non–Insulin Dependent Diabetic Patients with Other Medication

Parameter	Estimated Coefficient	Standard Error	Odds Ratio
Demonstration (1,0)	0.25***	0.05	1.28
Year two	0.39***	0.06	1.48
Male	0.21***	0.03	1.24
Age birth to 17 years	–3.45***	0.26	0.03
Age 18 to 45 years	–0.90***	0.05	0.41
Age 65+ years	–0.24***	0.04	0.79
Interaction terms			
Demo * year two	–0.27**	0.07	0.76
Intercept	0.10*	0.05	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
NOTE: The omitted group for the model is quarter four, which is the baseline period that immediately preceded the start of implementation activities by the demonstration MTFs.

for the demonstration and control sites in years one and two are calculated in Table B.6.

In the baseline year, the demonstration sites had larger percentages than the control sites of non–insulin dependent diabetic patients using oral hypoglycemic agents. The percentages increased in the demonstration year for both the demonstration and control sites, and both increases were statistically significant. However, the increase for the demonstration sites was smaller than that for the control sites, indicating that introduction of the practice guideline did not have an effect on these trends.

The combined effects of the demonstration and year, and their interaction term, are shown in Table B.6 in the very similar odds ratios for the control and demonstration sites for year two. In addition, use of insulin, gender, and age all were significant predictors of use of other glycemic control medications. Insulin users and males were more likely to be prescribed these medications. Patients in referent age group of 46 to 64 years were the heaviest users of other control medications of all the age groups.

Annual Eye Examinations

The percentages of diabetic patients who had annual eye examinations, by group and individual MTF, are reported in Table B.7. The results of the logistic regression analysis of the percentage of patients with annual eye examinations are reported in Table B.8.

Overall, the demonstration sites had larger percentages of diabetic patients with annual eye examinations than the control sites did,

Table B.6
Comparison of Effect of Demonstration on Regression Coefficients and Odds Ratios for Use of Other Medications to Control Glycemia by Noninsulin Patients

	Year One		Year Two	
	Coefficient	Odds Ratio	Coefficient	Odds Ratio
Control				
Year two variable			0.39	1.48
Demonstration				
Demo variable	0.25	1.28	0.25	
Year two variable			0.39	
Demo * year two interaction			–0.27	
Sum of coefficients	0.25	1.28	0.37	1.45

Table B.7
Percentage of Diabetic Patients with a Diabetes-Related Annual Eye Examination, by MTF and Year

	Percentage of Noninsulin Patients with Eye Exam	
Facilities	Study Year One	Study Year Two
Demonstration Sites	10.6	19.5
Demo 1	4.5	5.8
Demo 2	20.7	25.8
Demo 3	14.6	33.0
Demo 4	9.0	0.3
Demo 5	15.9	36.8
Control Sites	5.2	6.5
Control 1	0.3	0.0
Control 2	6.9	6.3
Control 3	18.8	21.0
Control 4	12.1	12.0
Control 5	0.5	8.7

Table B.8
Logistic Regression Model of Estimated Guideline Effects on Number of Diabetic Patients with Annual Eye Examinations

Parameter	Estimated Coefficient	Standard Error	Odds Ratio
Demonstration (1,0)	0.78***	0.10	2.18
Year two	0.25*	0.12	1.28
Male	0.12**	0.05	1.13
Age birth to 17 years	–0.59**	0.18	0.55
Age 18 to 45 years	–0.36***	0.08	0.70
Age 65+ years	–0.14**	0.05	0.87
	0.08	0.07	1.08
Interaction terms			
Demo * year two	0.47**	0.13	1.59
Intercept	–2.88***	0.09	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
NOTE: The omitted group for the model is year one, which is the baseline period that immediately preceded the start of implementation activities by the demonstration MTFs.

as shown by the significant coefficient and large odds ratio (2.18) for the "demo" variable. The percentage with eye examinations increased in the second study year for both the demonstration and control sites (positive and statistically significant coefficient for the "year two" variable), and the increase was greater for the demonstration sites (positive and statistically significant interaction term for demo*year). In addition, gender and age were significant predictors of use of other control medications, but insulin use was not. Males were more likely than females to be prescribed these medications. Patients in referent age group of 46 to 64 years were the heaviest users of primary care services of all the age groups.

ER Visits

The average rates of ER use per 1,000 diabetic patients, by group and individual MTF, are reported in Table B.9. The results of the ordered logistic regression analysis of emergency department visits for diabetes patients are presented in Table B.10 and B.11.

The regression results in Table B.10 include all the demonstration sites, and the results in Table B.11 exclude one demonstration

Table B.9
Average Annualized ER Visit Rates per 100 Diabetic Patients, by Demonstration and Control Sites and Quarter

	Study Year One Quarters				Study Year Two Quarters			
Facilities	**1st**	**2nd**	**3rd**	**4th**	**1st**	**2nd**	**3rd**	**4th**
Demonstration Sites	4.4	3.6	4.0	3.6	4.0	5.6	8.0	10.8
Demo sites without								
Demo 3[a]	6.0	3.2	3.2	2.4	2.8	2.0	1.6	3.2
Demo 1	6.4	5.6	5.2	3.6	4.8	4.4	3.6	6.4
Demo 2	3.6	3.6	10.8	14.4	3.2	6.4	15.6	0.0
Demo 3	0.8	0.4	1.2	0.4	0.4	4.0	14.4	21.6
Demo 4	8.8	6.0	6.4	7.2	8.8	8.8	8.4	4.8
Demo 5	4.4	4.4	5.2	7.2	6.0	8.4	3.6	4.4
Control Sites	2.0	3.2	3.2	2.4	2.8	2.0	1.6	3.2
Control 1	1.6	4.0	3.2	0.8	1.6	0.8	1.6	1.6
Control 2	2.4	7.6	2.4	7.6	25.2	12.4	12.4	1.6
Control 3	3.6	2.4	8.0	5.6	4.4	3.2	2.0	7.6
Control 4	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Control 5	4.8	4.0	4.8	4.8	4.4	4.4	1.2	0.0

[a]Separate analyses were performed with and without Demo 3, which had an unusual trend in ER visits that differed from the other sites.
NOTE: Annualized primary care visit rates are calculated as four times the number of visits in a quarter divided by the number of patients in the relevant study year and applying 100 as an adjustment factor to standardize to a rate per 100 patients.

site that was an outlier with a large increase in ER visit rates during the demonstration period. The regression results for all demonstration sites (Table B.10) reflect the increased rates for that facility, with increasingly positive and statistically significant coefficients on the interaction terms for demonstration sites by quarters 5 through 8. With that facility omitted, we found no significant trend in ER visits for the demonstration sites, relative to rates for the control sites (Table B.11). Thus, these results indicate that the demonstration did not contribute to decreased use of the ER for diabetes-related problems, which is what we had hypothesized would occur as more aggressive care management practices were implemented.

Also of interest, use of insulin and age were significant predictors of use of ER visits, but gender was not. Insulin users were more likely to use ER services. Pediatric patients (age birth to 17 years) had the highest rates of ER visits, and younger adults (age 18 to 45 years)

Table B.10
Logistic Regression Model of Estimated Guideline Effects on Number of ER Visits per Diabetic Patient, All Demonstration and Control Sites

Parameter	Estimated Coefficient	Standard Error	Odds Ratio
Demonstration (1,0)	0.26	0.14	1.30
Quarter 1	0.14	0.17	1.15
Quarter 2	0.11	0.17	1.11
Quarter 3	0.21	0.17	1.24
Quarter 5	0.02	0.29	1.02
Quarter 6	–0.30	0.32	0.74
Quarter 7	–0.37	0.33	0.69
Quarter 8	–0.07	0.30	0.93
Male	0.06	0.07	1.07
Age birth to 17 years	1.26***	0.14	3.51
Age 18 to 45 years	0.61***	0.1	1.85
Age 65+ years	–0.01	0.09	0.99
Insulin user	0.99***	0.08	2.71
Interaction terms			
Demo * quarter 5	0.12	0.30	1.12
Demo * quarter 6	0.72*	0.33	2.06
Demo * quarter 7	1.21**	0.33	3.35
Demo * quarter 8	1.19***	0.30	3.29
Intercept 1	–5.34***	0.18	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.
NOTE: The omitted group for the model is quarter four, which is the baseline period that immediately preceded the start of implementation activities by the demonstration MTFs.

also had higher rates than patients in the referent age group (age 46 to 64 years). The ER visit rate for older patients (age 65+ years) did not differ significantly from that of the referent age group.

Frequency of Hospitalization

The average numbers of hospitalizations per diabetic patient, by group and individual MTF, are reported in Table B.12 (all hospitalizations) and Table B.13 (hospitalizations for diabetes). The results of the logistic regression analysis of trends in frequency of hospitalizations are reported in Table B.14.

We had hypothesized that implementation of more aggressive care management practices by the demonstration sites would lead to reductions in hospitalization rates relative to those for the control sites. We found no significant trend in hospitalization rates for the

demonstration sites, relative to rates for the control sites. Thus, these results indicate that the demonstration did not contribute to a decrease in complications or other health problems requiring hospital inpatient care for diabetic patients.

Table B.11
Logistic Regression Model of Estimated Guideline Effects on Number of ER Visits per Diabetic Patient, Excluding One Demonstration Site

Parameter	Estimated Coefficient	Standard Error	Odds Ratio
Demonstration (1,0)	0.62***	0.14	1.85
Quarter 1	0.14	0.17	1.15
Quarter 2	0.15	0.17	1.17
Quarter 3	0.20	0.17	1.22
Quarter 5	0.03	0.29	1.03
Quarter 6	–0.3	0.32	0.74
Quarter 7	–0.36	0.33	0.70
Quarter 8	–0.07	0.30	0.94
Male	0.05	0.09	1.05
Age birth to 17 years	1.30***	0.15	3.69
Age 18 to 45 years	0.68***	0.11	1.95
Age 65+ years	–0.08	0.12	0.92
Insulin user	0.97***	0.09	2.65
Interaction terms			
Demo * quarter 5	0.09	0.30	1.09
Demo * quarter 6	0.51	0.34	1.66
Demo * quarter 7	0.26	0.35	1.30
Demo * quarter 8	0.11	0.32	1.11
Intercept 1	–5.35***	0.17	

*** $p < 0.001$.
NOTE: The omitted group for the model is quarter four, which is the baseline period that immediately preceded the start of implementation activities by the demonstration MTFs.

Table B.12
Average Number of Total Hospitalization per 100 Diabetic Patients, by Demonstration and Control Sites and Quarter

	Average Number of Total Hospitalizations per 100 Patients							
	Study Year One				Study Year Two			
Facilities	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Demonstration Sites	42.0	36.8	38.8	41.2	45.2	42.0	39.2	41.6
Demo 1	40.0	39.6	34.0	38.4	42.8	40.4	38.4	36.8
Demo 2	21.6	7.2	10.8	14.4	43.6	50.0	65.6	31.2

Table B.12—continued

	Average Number of Total Hospitalizations per 100 Patients							
	Study Year One				Study Year Two			
Facilities	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Demo 3	57.6	42.8	47.6	45.2	55.6	44.8	42.4	51.6
Demo 4	31.6	22.4	32.4	38.4	28.8	41.6	32.8	34.0
Demo 5	20.8	30.0	36.8	46.0	42.0	39.6	35.2	38.4
Control Sites	27.6	29.6	28.8	27.2	26.8	26.4	24.0	29.2
Control 1	34.0	31.2	27.6	26.4	22.8	27.2	25.2	26.4
Control 2	17.6	20.0	22.8	25.2	16.8	25.2	0.0	62.4
Control 3	29.6	35.2	35.2	35.2	41.6	34.8	20.8	34.0
Control 4	13.2	20.4	22.8	21.2	24.4	18.4	14.4	20.8
Control 5	26.8	34.4	36.4	29.6	34.8	28.0	44.8	41.2

NOTE: Annualized primary care visit rates are calculated as four times the number of visits in a quarter divided by the number of patients in the relevant study year and applying 100 as an adjustment factor to standardize to a rate per 100 patients.

Table B.13
Average Number of Diabetes-Related Hospitalizations per 100 Diabetic Patients, by Demonstration and Control Sites and Quarter

	Average Number of Diabetes-Related Hospitalizations per 100 Patients							
	Study Year One				Study Year Two			
Facilities	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Demonstration Sites	30.0	28.8	26.0	29.2	34.0	32.0	29.6	32.4
Demo 1	31.6	32.4	26.8	31.6	34.0	32.8	29.2	30.8
Demo 2	18.0	7.2	7.2	14.4	28.0	34.4	50.0	22.0
Demo 3	38.4	32.0	28.4	28.4	2.4	32.4	32.8	41.2
Demo 4	20.0	16.4	18.4	25.2	18.4	29.6	22.8	25.6
Demo 5	14.4	25.2	26.8	29.2	30.0	30.4	26.0	23.6
Control Sites	20.0	19.6	21.2	18.4	19.2	16.8	16.8	22.4
Control 1	25.2	21.6	22.8	17.2	18.0	18.0	20.0	22.4
Control 2	2.4	0.0	2.4	5.2	4.0	8.4	0.0	16.8
Control 3	21.6	18.4	26.4	24.0	22.0	24.0	14.0	26.0
Control 4	8.0	15.6	14.8	16.4	18.8	9.6	7.6	12.0
Control 5	22.0	26.0	26.8	24.0	26.8	20.0	28.0	35.6

NOTE: Annualized primary care visit rates are calculated as four times the number of visits in a quarter divided by the number of patients in the relevant study year and applying 100 as an adjustment factor to standardize to a rate per 100 patients.

Table B.14
Ordered Logistic Regression Model of Estimated Guideline Effects on Number of Hospitalization per Diabetic Patient

Parameter	Estimated Coefficient	Standard Error	Odds Ratio
Demonstration (1,0)	0.13	0.10	1.14
Quarter 1	0.05	0.12	1.05
Quarter 2	0.16	0.12	1.17
Quarter 3	–0.1	0.12	0.90
Quarter 5	0.14	0.20	1.15
Quarter 6	–0.06	0.20	0.94
Quarter 7	0.26	0.21	1.29
Quarter 8	0.37	0.19	1.45
Male	0.17**	0.06	1.19
Age birth to 17 years	–0.71***	0.18	0.49
Age 18 to 45 years	–0.93***	0.10	0.40
Age 65+ years	0.01	0.07	1.01
Insulin user	1.09***	0.08	2.96
Interaction terms			
Demo * quarter 5	0.03	0.21	1.03
Demo * quarter 6	0.17	0.21	1.19
Demo * quarter 7	–0.19	0.22	0.83
Demo * quarter 8	–0.2	0.20	0.82
Intercept 1	–2.05***	0.12	
Intercept 2	0.93	0.12	

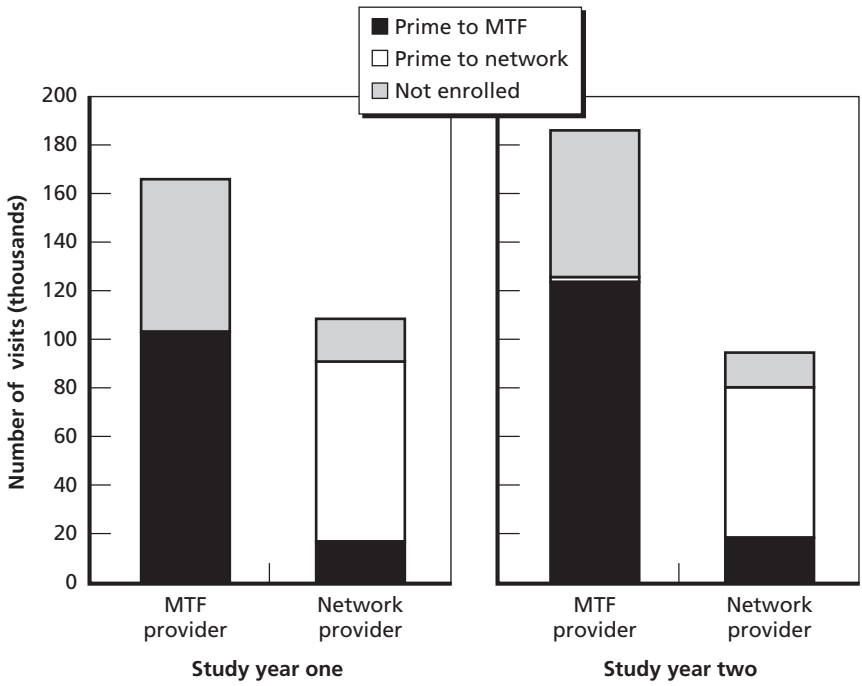
** $p < 0.01$, *** $p < 0.001$.
NOTE: The omitted group for the model is quarter four, which is the baseline period that immediately preceded the start of implementation activities by the demonstration MTFs.

Use of insulin, gender, and age all were significant predictors of hospitalization rates. Insulin users and male diabetic patients were more likely to be hospitalized. Pediatric patients (age birth to 17 years) and younger adults (age 18 to 45 years) had lower hospitalization rates than patients in the referent age group (age 46 to 64 years) did, but the rate for older patients (age 65+ years) did not differ significantly from that of the referent age group.

APPENDIX C

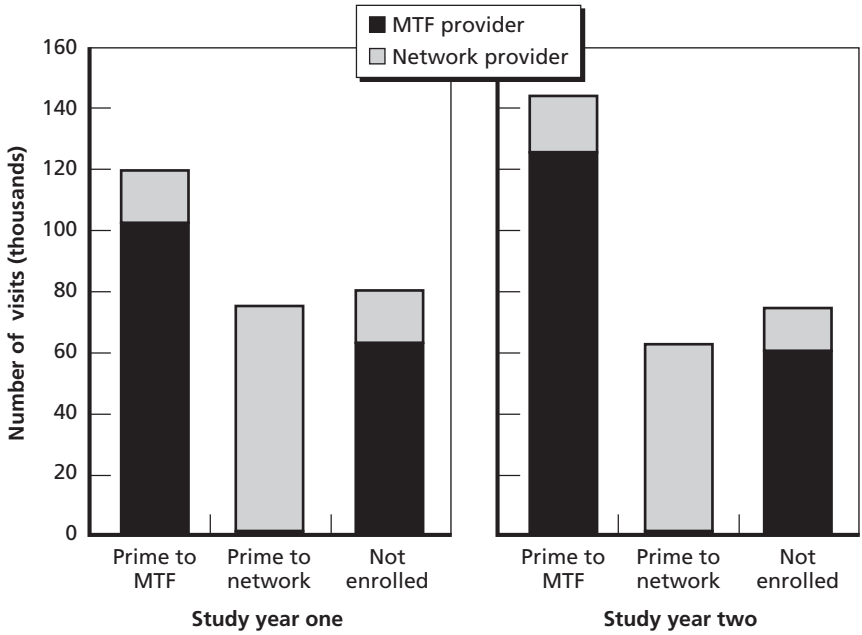
Graphic Representation of Baseline Service Use Data

Figure C.1
Outpatient and ER Visits to MTF and Network Providers by Patient Enrollment Status and by Study Year



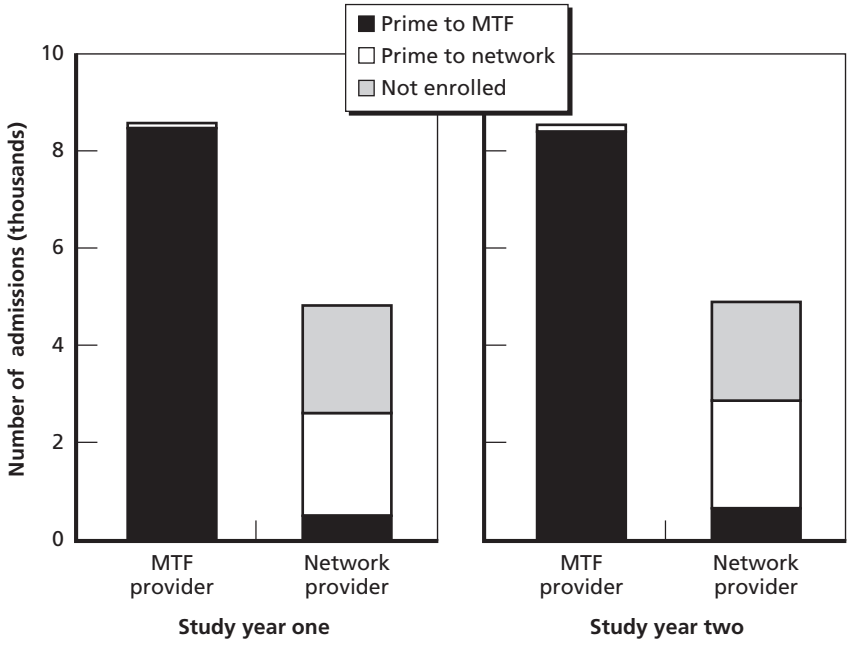
RAND *MG277-C.1*

Figure C.2
Outpatient and ER Visits of MTF and Network Enrollees and Nonenrollees to MTF and Network Providers, by Provider Type and Study Year



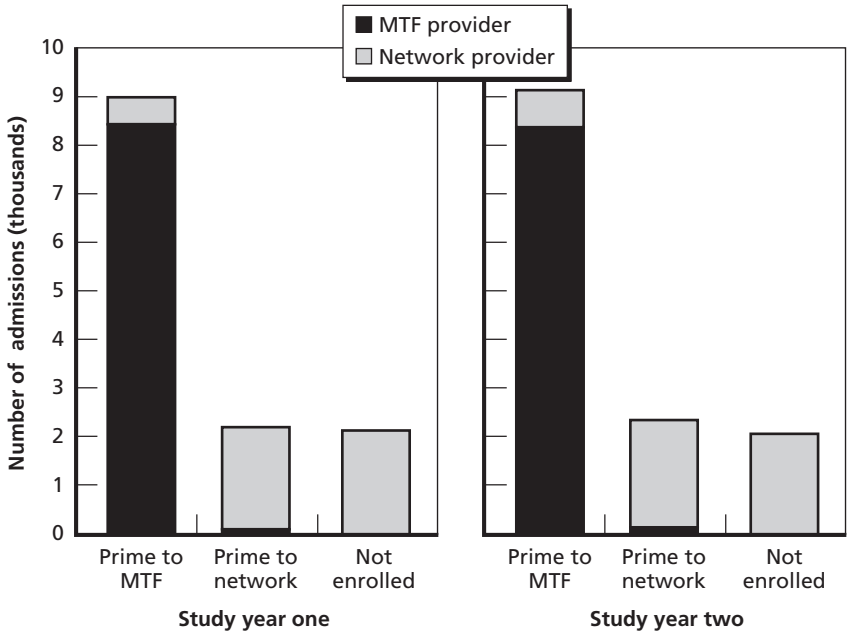
RAND *MG277-C.2*

Figure C.3
Enrollment Status of Patients for Inpatient Admissions at MTFs and Network Providers, by Study Year



RAND *MG277-C.3*

Figure C.4
Inpatient Admissions at MTFs and Network Providers, by Enrollment Status of Patients and Study Year



RAND *MG277-C.4*

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